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The Massachusetts State Railroad Commissioners recommend a law compelling the use of the block system on the railroads of that State, thus putting themselves in line with the Interstate Commerce Commission and with Congressman Esch. The Massachusetts report (which we give on another page) does not present much of an argument in support of the recommendation; but it states one fact which ought to make argument for the use of the block system unnecessary, the fact that in the minds of all competent judges the question is already settled; "the day for discussion is passed." Whatever may be said about legislation on the subject, it is clear that the main reason for the continuance of the time interval system of running trains is the fact that the railroads have not yet found it convenient to make the necessary outlay of money. On the subject of train rules the Commissioners also utter a sound opinion, but offer no argument. They say that the rules—referring particularly to those of the Boston & Maine—need to be made plainer. The Massachusetts board has, however, dealt with this subject before, and in clear terms. But a sound opinion does not accomplish anything. In spite of the declarations of this and other commissions, and in spite of the work of the American Railway Association, train rules everywhere are faulty, and only the introduction of the block system on the busiest lines has prevented this defective condition from resulting in disaster. It is time to confess that this work has suffered from superficiality, if not from neglect. Such success as has been attained in the running of trains on those American roads where the block system is not used, is due to something else than perfect rules. To carry out the spirit of this Massachusetts recommendation it will be necessary to delve into the subject after the manner of Mr. Forman; and, like him, to keep in very close touch with the trainmen while doing it. Committee recommendations which anybody may modify as he pleases, or ignore entirely, must always be subject to the defect of inadaptability, because the work has to be done at arm's length; because a national committee is necessarily so small as compared with the number and variety of minds to be satisfied.

The commissioners' views on the Baker Bridge collision are so closely in accord with those which we have ourselves expressed that we do not take the space to quote them in full. The implied criticisms in the Grand Jury's presentment, concerning hours of work and the relations of employer and employee, already published in the *Railroad Gazette*, again appear as implied—not direct—criticisms in the present report. One thing which the commissioners appear to have passed over with slight attention is the question of the fitness of the fireman of the leading engine of the express train. This man was instantly killed. Theoretically, the fireman is an assistant lookout man—as much of a lookout man as he can be and properly attend to his fire. If this function is ever of value it must be particularly so on a fast train, which is following closely behind a slower one and which is run by an inexperienced engineman. We hear that the fireman of this engine on this trip was inexperienced, so much so that the engineman assisted him in firing—which, incidentally, affords another illustration of a thing often seen in the higher ranks of the railroad service, the propensity of a man who is promoted to continue giving his thought and much of his energies to that department of the work which he has just relinquished. If this engineman got down and shoveled coal into the firebox no further evidence is needed to show the parallelism between this and the Westfield (New Jersey) case. The engineman's published assertion that he saw the lanterns and fusees at Lincoln and beyond there, but could not explain why he disobeyed them, excited universal incredulity; and his subsequent statement (as now given by the railroad commissioners) that he applied the brakes, which statement appears to be wholly demolished by the testimony of the runner of the second engine, only increases the suspicion that the facts were not fully divulged. Collisions would afford very much less ground for grave discussions about the mysteries of the personal equation if only the public could always have the true facts about bald and knowing disregard of the very simplest rules.

THE KANSAS CITY, MEXICO & ORIENT.

We have several times taken occasion to point out that the distinguishing characteristic of 1905, from a railroad construction standpoint, was the extraordinary recurrence of building to the Pacific Coast. After the previous years of maximum opening of new territory, like 1882 and 1887, there was a long time when railroad development was either of a local character, such as the opening of Texas, Oklahoma and Indian Territory; or, in more recent years, was devoted primarily to rebuilding existing lines, making cut-offs where old locations were unfavorable, reducing grade and curvature

and equipping the crude pioneer routes to handle a tremendously increased business under modern economical conditions. But following this, and following the Northern Securities decision, we now have the Grand Trunk Pacific building to the coast in Canada, with the Canadian Northern looking on as an interested observer, apparently ready to step in and do likewise within a few years. South of the border, the Chicago, Milwaukee & St. Paul has announced its plans of building to the coast in Great Northern and Northern Pacific territory; the Western Pacific has been financed, and work has been begun on this Gould connection from the Rio Grande system through to Oakland; the San Pedro, Los Angeles & Salt Lake has been built and sold to the Harriman lines, while the Denver, Northwestern & Pacific offers an important connection between Denver and Salt Lake, with easier grades than those of existing lines. It is safe and fair to say that all of these projects are genuine ones, built to meet a real need and in the hope of great future business, rather than to aid any promoter or series of promoters in an access to sudden wealth. Further south, another Pacific line is now building, and it is unfortunate that the same assurances cannot in this case be given.

The Kansas City, Mexico & Orient commenced construction work in May, 1900, simultaneously in the United States and in Mexico, on a proposed line to be built from Kansas City to Topolobampo, far down on the Gulf of California. Since that time work has been pushed vigorously on this road at a number of separate points. Approximately 100 miles of line in Oklahoma were opened in 1903, and in 1904 about the same amount of track was being operated in Mexico. Meantime provision was made for an entrance into Kansas City; and during 1905, 75 miles of line was completed in Texas, 50 miles in Oklahoma, and 100 miles more in Mexico, a considerable mileage in Kansas having been opened the year previous. Trains are now running on four portions of the route: From Wichita, Kan., through to Oakwood, Okla. T., 157 miles; from Sagerton to Sweet Water, Tex., 52 miles; and in Mexico, eastward from the Gulf terminus to Hornillos, 73 miles; and from Chihuahua to San Sostenes, 73 miles additional.

The promoters base their claims for the prosperity of the line on two main points: The fact that they have the shortest route from the great producing and consuming part of the West to the Pacific Coast, and the additional fact that they pass through a territory which they consider to have great agricultural possibilities, and which is as yet practicaly unworked. The project is a novel one, and it is worth while to consider carefully these points, viewed in the light of such information as is now at hand. With regard to the specific distance: The Kansas City, Mexico & Orient route comprises, roughly, 271 miles in Kansas, 200 miles in Oklahoma, 560 miles in Texas, and 475 miles in Mexico; a total, as originally announced, of 1,506 miles from Kansas City to Topolobampo, although it is to be presumed that this will pan out a little longer by the time the work has been done. The road which affords the closest comparison is perhaps the Atchison, with a mileage of 2,120 miles from Kansas City to San Francisco. Of the other American transcontinental lines, so-called, the Harriman route from Omaha to San Francisco is 1,848 miles long; the Great Northern route from St. Paul to Seattle, 1,829, and the Northern Pacific route from St. Paul to Seattle, 1,913 miles. The Kansas City, Mexico & Orient announces that the Hamburg-American Packet Company has entered into a contract to furnish an Oriental service from Topolobampo as soon as the railroad is completed; therefore, it is perhaps well to consider first the possibilities of the road with regard to this traffic, which has been so carefully studied in the north by Mr. Hill. The reason for the short land distance of this route is, of course, accounted for by the eastward slope of the coast, which furnishes tidewater at Topolobampo some 16 degrees east of tidewater at Seattle and some 13½ degrees east of San Francisco. Of course, the great circle ocean route from Mexico is much longer than the route for transpacific steamers further north, so much longer, in fact, that the rail distance is vastly more than neutralized thereby, not only in actual miles, but also taking into consideration the greater economy of water as compared with rail haul. It requires a globe rather than a flat map to demonstrate to the casual reader that the nearest route from Mexico to Japan lies by way of the San Francisco coast and the Aleutian Islands, but this is indeed the case. It will be seen, therefore, that the Kansas City, Mexico & Orient will have no advantage in distance or economy, so far as Oriental trade is concerned, by its shorter rail route. Moreover, we have not yet considered the grades. Just what the new line can do with its route over the Sierre Madre mountains we are not prepared to say at present, but if it gets off with a three per cent. grade it will surprise most observers of this territory. The existing transcontinental lines now have their grades well in hand, and, without going into this part of the discussion in detail, it is fair to say that the new line has yet to demonstrate that it can do anywhere nearly as well in this respect as the lines which now reach the coast.

But the present coast lines are not dependent on their Oriental traffic for existence. They have also a rich and constantly increasing local and branch line traffic to support them. We have called attention to the recent and very notable branch line extension work of the Union Pacific, and surely nothing more than an allusion need be made to the great grain crops hauled by the northern lines and to the traffic in citrus fruits, etc., which is handled by the Southern Pacific. The Kansas City, Mexico & Orient strikes a section of country which seems of much less promise than that traversed by the other routes. It is less well built up, its grain is not so good, and it has fewer natural advantages. This is true from Kansas City almost as far as Chihuahua. What the traffic possibilities of this part of Mexico are it is hard to say, but they have not sufficed to attract much railroad building as yet.

With these facts in mind, it must frankly be said that the prospects of the line appear more interesting than inspiring. In the face of this may be made the confident prediction that it will be built ,and built rapidly to completion. Mexico has given handsome subsidies; aid has been granted by numerous towns on the route, and the subscriptions to the construction capital seem to have been liberal. Whether the road can make a living when built, and, if so, how it is going to make it, are interesting questions for the next few years to determine. In the meantime, the project stands as an example of a kind of construction that has not been much attempted in the United States within the last generation.

RAILROAD ROUTES TO THE GULF.

The two most persistent rumors of impending changes in railroad control each relate to the purchase by a northwestern line of an outlet to the Gulf of Mexico. The Hill roads, through the Burlington, are widely credited with the purpose of securing a gulf connection by taking over the Missouri, Kansas & Texas; and the Chicago, Milwaukee & St. Paul is known to have at least been considering the desirability of getting control of the Kansas City Southern. Ownership of the Missouri, Kansas & Texas would give the Burlington a fairly direct north and south line from Kansas City to Galveston, and would also connect with Burlington lines at St. Louis, which it now enters over Burlington rails, and Hannibal, Missouri. The Kansas City Southern would join the St. Paul's Kansas City line to Port Arthur, a good harbor on the gulf, some 75 miles east of Galveston.

The foundation basis for reports such as these lies in the rapidly increasing importance which has within the last few years come to be assumed by the gulf ports as exporters of grain. Grain is the most spectacular commodity which the railroads carry—the one over which rate wars are most frequent and about which rate adjustments are most sensitive. Within the last two or three years, New Orleans, in particular, and Galveston as well, have been taking away from the Atlantic ports a large share of the grain export business—this in spite of all the influence of long established custom in the grain export trade to the contrary. The map of the United States shows pretty clearly the natural reasons for such a change. Grain from almost any point in the principal grain producing states of the country is going out of its way, so far as distance is concerned, in reaching the Atlantic seaboard for export. It is from 200 to 300 miles shorter from Iowa and the Dakotas to Galveston or New Orleans than to New York, Boston, Philadelphia or Baltimore. From the grain raising states further south, the advantage of the gulf ports in distance is, of course, greatly increased. Then, too, the north and south routes to the gulf follow, in general, water grade lines; that is, they run parallel to the general trend of the streams in that territory. On the other hand, by every route, with the exception of the New York Central, between Chicago or St. Louis and United States ports on the Atlantic, freight has to cross the summit of the Allegheny mountains.

There are, however, certain advantages which the Atlantic ports possess over their new competitors. The machinery of export has long been centered on the Atlantic seaboard, and it is never an easy matter to change the current of an established way of doing things. More than this, in the case of the larger eastern ports, particularly

New York, the size of the cities and the commercial development of the country back of them tend to center the export trade at their docks, because vessels can always find a cargo to bring when they come in to get grain. In the case of the gulf ports—though with the growth of the South and Southwest this is decreasingly true—vessels have in many cases to arrive in ballast, owing to the small demand in that territory for general imports. This means, of course, that in such case the export grain rates have to be large enough to cover the expenses of both the inbound and outbound trip. As has also frequently been pointed out in the *Railroad Gazette*, New York in particular has a further very great natural advantage in export grain rates. Not only can steamers always find lading to bring to New York but grain export rates are also lower on account of the large amount of other exports from that port. The rates at which export grain is carried are of two sorts: cargo rates, where a whole, or substantially a whole, ship is chartered, and berth rates, where a ship carrying a general cargo has extra room available. Grain very conveniently fills up such extra spaces at a late moment before sailing, since it requires no handling or stevedoring in the berths to which it is assigned, and as a consequence berth rates are low. Therefore, aside from other considerations, through the competition of berth-rate business, grain can in general be exported more cheaply from a port where there are a large number of steamers engaged in miscellaneous traffic.

In expense of terminal facilities, on the other hand, the gulf ports have a great advantage. Available locations for terminals on New York harbor are very many times as expensive as similar and equally available locations near New Orleans. Comparison between the less important Atlantic and gulf ports would show much greater difference in this expense. Certain gulf ports which possess as good harbors as some of the most important Atlantic ports are not large cities but places where land is comparatively cheap. In addition to the much greater cost of land, various terminal charges have grown up at some of the eastern ports, particularly at New York, which, though perhaps they would be equally justifiable at some of the gulf ports, are, in order to attract business, not applied there. In short, the competition boils down to this—that the Atlantic ports have the extensive advantages which result from undisputed possession for many years of the export trade and from their much greater commercial importance, while the gulf ports have the advantages of cheap terminal facilities and in particular of their natural geographical location.

The interest in the subject at the present moment, aroused particularly by the Missouri, Kansas & Texas and Kansas City Southern rumors, makes it interesting to take stock of the routes which are at present open to grain export via the gulf. From Chicago, the Illinois Central, with its low-grade line 914 miles long from Chicago to New Orleans, holds a commanding position. Over the Chicago & Eastern Illinois from Chicago to Terre Haute, the Evansville & Terre Haute from Terre Haute to Evansville, and the Louisville & Nashville from Evansville to New Oreans, the distance is 1,068 miles. Through the acquisition on January 1st of last year, by the St. Louis & San Francisco, of trackage rights for freight trains over the Mobile & Ohio and New Orleans & Northeastern, between Tupelo, Miss., and New Orleans, a new route was formed over the Chicago & Eastern Illinois and St. Louis & San Francisco via Thebes Bridge and Tupelo, 993 miles between Chicago and New Orleans. From St. Louis there are 11 routes, the shortest, to New Orleans, over the Mobile & Ohio and the New Orleans & Northeastern, 705 miles. The Illinois Central line between the same points is 711 miles long; the Frisco via Memphis and Tupelo, 748 miles, and the Missouri Pacific and Texas & Pacific, via Texarkana, Tex., 891 miles. The Louisville & Nashville has the longest route, with 945 miles between St. Louis and New Orleans. From St. Louis to Galveston the shortest route is 860 miles, by the Missouri Pacific, Texas & Pacific and International & Great Northern. The same haul over the St. Louis & San Francisco and Houston & Texas Central, via Sherman, is 1,031 miles long. There are also three routes to ports east of New Orleans: By the Mobile & Ohio, from St. Louis to Mobile, 644 miles; the Louisville & Nashville, from St. Louis to Mobile, 805 miles, and by the Louisville & Nashville from St. Louis to Pensacola, 787 miles.

Last of all come the routes between Kansas City and the gulf, which are particularly important because Kansas City is the point through which most of the export grain via the gulf is hauled. The Kansas City Southern from Kansas City to Port Arthur has the shortest line from Kansas City to any point on the gulf, 786 miles. Between Kansas City and Galveston the Missouri, Kansas & Texas is 884 miles long. By Santa Fe lines the distance between these same points is 916 miles, and by the Missouri Pacific and International & Great Northern, including 268 miles over the Missouri, Kansas & Texas, 890 miles. The Frisco system has the shortest Kansas City-Galveston line, 873 miles long, including 385 miles over the Houston & Texas Central; also the shortest line between Kansas City and New Orleans, 879 miles long, including 395 miles between Memphis and New Orleans over the Illinois Central. By making use of its trackage over the Mobile & Ohio and New Orleans & Northeastern, the Frisco has its own line, 927 miles long, to New Orleans. The Missouri Pacific and Texas & Pacific together form a line 1,067 miles long between these same points.

These include practically all of the existing gulf routes. In addition, several other companies are reaching south toward the gulf. The Colorado & Southern has announced plans for an extension from Fort Worth to Galveston, and thence eastward to New Orleans. The Rock Island not long ago bought the Arkansas Southern, a line extending 100 miles south from the Arkansas line into Louisiana, has work now under way to connect this with the rest of its system, and has recently acquired a new charter empowering it to build on south to Alexandria and beyond to New Orleans. The Missouri Pacific, through the Iron Mountain, is building a low-grade line along the west bank of the Mississippi river which, in connection with the Texas & Pacific at the southern end, will give the Gould companies a favorable line between St. Louis and New Orleans. Two new cut-offs in Arkansas, one building, the other already built, will also shorten considerably the Missouri Pacific's line from the territory about Kansas City to New Orleans. It is notable that all the southwestern lines which have heretofore stopped short of the gulf are reaching out for a share in the gulf traffic.

Of the existing gulf routes, with two exceptions, every one is either itself part of, or controlled by, one of the large railroad corporations. The Illinois Central is itself one of the strongest railroads in the country. The Chicago & Eastern Illinois, Evansville & Terre Haute, and St. Louis & San Francisco are all controlled by Rock Island ownership. The Mobile & Ohio and New Orleans & Northeastern are properties of the Southern Railway; the Louisville & Nashville is held by the Atlantic Coast Line, and the Missouri Pacific, Texas Pacific and International & Great Northern are parts of the Gould system. The Houston & Texas Central is a Southern Pacific line. Nor is the Atchison, Topeka & Santa Fe likely to be bought up as some other road's gulf connection. These cover all the gulf routes, except the Kansas City Southern and the Missouri, Kansas & Texas, the first of which connects Kansas City and the second both Kansas City and St. Louis with the gulf over its own rails. The situation, then, is that if any of the northwestern railroads wish to acquire a gulf outlet, these two roads form the only available material which can be acquired in the open market at anything like reasonable expense. Kansas City Southern stock is selling at 62 for the preferred and 32 for the common, and there is $21,000,000 preferred and $30,000,000 common outstanding. This makes the value of the road at present prices $22,620,000. Missouri, Kansas & Texas sells for about 71 for the preferred and 39 for the common, which makes the value of the $13,000,000 preferred and $63,300,300 common stock about $34,000,000. Actual control could, of course, in either case be bought for about half these amounts. Whether either of these roads, taking into account their physical condition, their situation in highly competitive territory, and their individual finances, would be worth that amount to one of the northwestern lines is a question which can only be decided upon by the managements of those roads. Judging from the recent tendency of the grain export business, it seems as though they might be. Acquisition of the Kansas City Southern by the St. Paul would require some building of additional connections in order to avoid hauling grain east as far as the Mississippi river before starting for Kansas City; but this would not be a difficult matter. All that is at present public property in regard to a Kansas City Southern purchase is President Earling's statement that, "I am not quite sure whether the St. Paul wants that road." A decision that it does want the Kansas City Southern would no doubt be greatly influenced by the fact that the St. Paul will within a few years reach the Pacific coast at Tacoma and Seattle, when a gulf connection would have a greatly added value. The Missouri, Kansas & Texas would similarly be useful not only to the Burlington as an outlet to the south for its large grain traffic, but to the Hill transcontinental lines as an originator of the cotton traffic to the Orient which Mr. Hill has so consistently tried to build up. According to statements credited to Burlington officials, the Missouri, Kansas & Texas now originates

a large amount of cotton tonnage which goes west for export over the Burlington and Northern Pacific or Great Northern to the Pacific coast. If trade to the Orient keeps on increasing at anything like the rate it has recently grown, the value to the Hill roads of a line south from Kansas City to the gulf should correspondingly increase. With the Missouri, Kansas & Texas in possession the whole haul from the gulf or the intermediate states would be over Hill system rails.

In any case, whatever becomes of these two properties, every new adjustment of rates shows that the most important controversy still to be settled is the proper relation between gulf and Atlantic ports. The most interesting phase of the conflict of interests at the moment is as to whether any of the northwestern or transcontinental lines will, or perchance already have, come to the conclusion that instead of turning over export grain to other roads at Chicago or the Missouri river it is worth their while to pay the price necessary to make it possible for them to carry it over their own rails for the whole haul from the grain fields to tidewater on the gulf.

Railroad Gross Earnings in October.

The gross earnings during October, while continuing to show large increases, would have made a much better showing if the roads had been able to handle all the traffic offered. An exceptionally severe car shortage existed during this month in all sections of the country, except possibly on the Pacific coast. Equipment was being worked to its fullest extent, as is shown by the reports of 37 car service associations, which handled during this month 3,222,911 cars, as against 2,845,951 cars during the same month of 1904. The fact that the earnings this month compared with a month last year, when the Louisiana Purchase Exposition at St. Louis was still giving many roads an enormous passenger traffic, accounts for decreases this year in the earnings of the Chicago & Alton, the Big Four, the St. Louis & San Francisco, the Wabash, the Missouri, Kansas & Texas, and also some of the southern roads, which suffered in addition from the condition of traffic in the south referred to below. Of the trunk line group, six roads report gross earnings of $30,909,132, an increase of $3,030,055, 11 per cent. As affecting these roads, it is interesting to note that the eastbound grain movement from Chicago and Chicago centers was 9,746,000 bushels, an increase of over 4,000,000 bushels over October, 1904. The gross earnings of ten of the coal roads amounted to $22,501,689, an increase of $2,028,899, 10 per cent. Anthracite shipments show only a small increase and bituminous traffic, especially, was hampered by lack of cars. The iron and steel trade, however, which was booming, helped the roads of this group, although in most cases the increases were probably due to the detouring of freight over other lines by larger systems which could not take on their main lines all the traffic offered. The Pennsylvania, which controls several coal roads, has been doing this a great deal for several months. The Norfolk & Western undoubtedly owes some of its increase to the activity of construction work on the Tidewater Railroad, the N. & W. having a monopoly on hauling the supplies for this new road and also the material for new industries which are locating on its route. In the southern group, nine roads report gross earnings of $18,885,189, a decrease of $30,255, one-sixth of 1 per cent. Only one road of this group shows a substantial increase, and this is very evidently due to the diversity of its traffic, which enabled it to make up for the decreased traffic in cotton, the net overland movement of which amounted to only 82,397 bales, as compared with 114,079 bales in 1904. Of the granger roads, seven show gross earnings of $21,152,340, an increase of $2,154,809, 11 per cent. The harvest in Minnesota and Dakota was finished in October and was greater per acre than in any season for ten years. The wheat crop in these states amounted to 187,482,020 bushels, an increase of 33,689,020 bushels, and other crops show similar results. The receipts of grain at 12 interior markets were 93,823,139 bushels, an increase of over 18,000,000 bushels. Of the southwestern group, five roads report gross earnings of $15,579,806, an increase of $1,253,035, 9 per cent. In 1904, the labor troubles in Colorado decreased the earnings of some of these roads, so the figures this year are large in comparison. The cotton and corn crops in this section were large, and the live-stock movement also increased, the receipts at six interior sections increasing nearly 14 per cent. Of the transcontinental roads, five show gross earnings of $33,762,772, an increase of $3,959,416, 13 per cent. Officials of the Great Northern were reported as saying that twice as many carloads of freight were shipped east from the state of Washington in October as ever before. The amount of lumber carried increased slightly. It is noticeable in regard to the traffic of the northern roads of this group that grain shipments by sea from San Francisco were about 670,000 bushels (50 per cent.) less than in 1904, and the figures for shipments from Tacoma show an increase of nearly as many bushels, making evident one respect in which the northern roads are profiting at the expense of those further south.

The accompanying table shows the gross earnings of 46 roads for October, 1905, and the increase over the figures for October, 1904.

	Month of October.	
	1905.	Increase over 1904.
Atchison, Topeka & Santa Fe	$6,793,290	$1,243,910
Atlantic Coast Line	1,986,461	69,778
Baltimore & Ohio	6,853,792	672,719
Buffalo, Rochester & Pittsburg	818,836	72,437
Canadian Pacific	5,722,767	978,805
Central of Georgia	1,080,492	*27,212
Central of New Jersey	2,158,112	250,510
Chesapeake & Ohio	2,039,665	232,198
Chicago & Alton	1,097,778	*203,005
Chicago & North-Western	6,148,512	775,942
Chicago Great Western	871,126	106,262
Chicago, Milwaukee & St. Paul	5,598,603	582,984
Chicago, Rock Island & Pacific	4,842,716	523,903
Chic., St. P., Minneapolis & Omaha	1,367,479	80,694
Cin., New Orleans & Texas Pacific	710,650	54,068
Cleve., Cin., Chicago & St. Louis	2,067,682	*134,888
Colorado & Southern	1,060,988	169,515
Denver & Rio Grande	1,840,135	157,757
Erie	4,412,629	474,565
Great Northern	5,708,211	890,893
Hocking Valley	599,509	29,626
Illinois Central	4,481,706	*96,034
Interoceanic of Mexico	247,327	3,325
Lehigh Valley	3,031,261	25,796
Louisville & Nashville	3,579,772	25,011
Mexican Central	1,218,160	89,042
Mexican International	278,260	*14,907
Minn., St. Paul & Sault Ste. Marie	1,226,126	288,029
Missouri, Kansas & Texas	2,165,465	*195,461
Nashville, Chatt. & St. Louis	919,658	16,134
National R. R. of Mexico	553,734	78,789
New York Central & Hudson River	8,138,377	961,558
New York, Ontario & Western	662,412	69,834
New York, Susquehanna & Western	255,728	34,867
Norfolk & Western	2,393,037	351,310
Northern Pacific	6,230,972	853,137
Pennsylvania Railroad Company	11,692,978	1,843,400
Philadelphia & Reading	3,689,337	289,602
Pitts., Cin., Chic. & St. Louis	2,447,245	278,362
St. Louis & San Francisco	3,719,928	*122,686
St. Louis Southwestern	844,051	*65,645
Southern	4,666,160	231,857
Southern Pacific	9,392,428	453,960
Union Pacific	6,708,394	782,621
Wabash	2,150,221	*392,942
Yazoo & Mississippi Valley	616,239	*238,212
Total	$145,088,406	$12,552,206

* Decrease.

That railroads in the United States aggregating over 4,000 miles in length are operated without the use of the telegraph is a surprising fact; yet a mileage considerably larger than that may be figured out from the information given in the *Official Guide*. The explanation is that these railroads, all of them of minor importance, have telephone lines. The fact is still surprising, from one point of view, because of the assertion so many times made, that the telephone is not a safe instrumentality for sending train-orders. Evidently these roads—there are one hundred and thirty-seven of them—use it for such orders as they have to send. Many of them are very short, and some have no reguiar business but freight; some of them, moreover, have only one locomotive—the greatest safeguard against collisions of trains that was ever invented—but taking all these lines together, there must be a good many train orders and therefore many chances for collisions, if mistakes in orders are to be considered a cause of collisions; so that on the whole this extensive use of the telephone must be considered good evidence of its availability. Besides the roads in the class here alluded to, the telephone, as everybody knows, is used to some extent for train orders on the Pennsylvania, the Illinois Central and other large roads. Besides the 137 roads referred to, a number of roads are entered in the *Official Guide* as having both telegraph and telephone lines.

NEW PUBLICATIONS.

Car Distributor. By O. O. Carr, Freeport, Ill. 4½ x 5¾ in.; 64 pages. Price, $1.00.

The full title of this book is "Car Distributor and Clerk to Chief Train Despatcher and Division Operator," and it is "devoted principally to economical methods of handling railroad freight equipment." Mr. Carr, who is car-distributor for the Illinois Central road at Freeport, has worked a number of years in the positions indicated by the title and has made good use of his experience; that is to say, he has done his work and surveyed his conditions with a studious mind and a philosophical spirit, so that what he knows he knows well enough to have the knowledge available when occasion arises for its use. He has filled his fifty small pages with solid matter which will be of interest to all doing this kind of work. He tells the train despatcher a great many things which the despatcher already knows, but it is useful, all the same, to have the matter put in print in compact form. It is to be regretted that the book has not been more carefully edited, for many passages are lacking in clearness. A characteristic sample of the matter and style of the book may be found in the following extract from "Miscellaneous Ideas on Handling Cars":

"Leaky roof, no door or other similar equipment fit only for rough freight loading should be worked to the stations or division

having a demand for such cars for rough freight loading. Watch agents loading cars with light weight freight off your line and insist on orders being placed for foreign cars, also watch agents loading merchandise cars and keep the loading consolidated much as possible. Keep in close touch with the traveling freight agent and acquaint yourself with the business he desires taken care of. Watch newspapers where car works contract to build new cars and if, when they are being turned out, you are extremely short of that class equipment, suggest that some of them be sent you for a round trip loading or a trip over your division. When you have difficulty in finding a proper foreign car for a shipment and such route will not deliver one of their cars, and you can take care of shipment with another foreign car by asking the agent to change the route to correspond with the available car, do so and save the business to your line. When a firm or connecting road is receiving more freight for a firm than can be consumed or received promptly and it ties up your equipment, take the matter up with your proper officer and recommend that a temporary embargo be placed against the further loading of such freight, ascertaining the actual daily consumption of such freight and lift the embargo in time to get the freight started again without allowing them to close down. When cars are being held with less car load lot shipments, have the agent unload and store in freight house, section men assisting, if necessary, in order to get the car released and in service. Local freight conductors should have copies of all circulars of instructions to agents about handling of cars, as a well posted local conductor is a valuable employee to a company and an unposted, careless one can tear down more car instructions in a month than you can build up in a year."

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3¾ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Water Wheels.—A neatly gotten up catalogue entitled "Doble Tangential Water Wheels" has just been published by the Abner Doble Company, San Francisco, Cal. The first portion contains general matter descriptive of the essential features and parts entering into the construction of Doble tangential water wheels, special attention being paid to the Doble needle regulating nozzles, ellipsoidal buckets, ring-oiling bearings, nickel-steel shafts, etc. Illustrations of several of different types of water wheels are followed by descriptions of some of the typical hydro-electric power plants in which the Abner Doble Company's water wheels are operating. These include some hydro-electric units of unusually large capacities which have recently been built in accordance with designs shown in the catalogue. Among them are two 8,000-h.p. wheels which were constructed for the de Sabla and Electra power houses, and a 9,000-h.p. wheel now building. An illustration is also given of the plant at Cornell University. This plant is of interest for the high efficiency, 84.5 per cent. obtained on the Doble wheels.

The latter portion of the book contains the Doble water wheel tables, covering all conditions of water power up to a head of 2,550 ft., and in capacities up to 5,000 h.p. Other tables relate to the loss of head in pipe by friction, riveted steel pipe, etc., and four pages contain useful hydraulic information. The last seven pages are devoted to a series of ready conversion factors, most of which have been compiled from a recent work by Carl Hering.

Personally Conducted California Tour.—The Chicago & North-Western sends a folder announcing a personally conducted tour to California of 41 days, leaving Chicago February 7. A special train will be used and the cost of the entire trip, including all necessary expenses, will be $350. The folder gives the itinerary, enumerates briefly the interesting points and things to be seen, and gives other particulars.

Corliss Engines.—The Allis-Chalmers Company, Milwaukee, Wis., sends a 20-page booklet descriptive of its "Reliance" Corliss engines. A full detailed description of the engine is given as well as a number of detailed illustrations of its parts. These engines are made in 20 sizes and a table showing the principal dimensions of each size is given.

Bridge Building, Conveying and Hoisting Machinery, Cranes, Etc.—A handsomely illustrated 6-in. x 9 in. catalogue containing upwards of 75 pages illustrates and describes the works and products of the Interstate Engineering Company, Cleveland, Ohio. Full page illustrations and brief descriptions of the following products made by the company are given: Locomotive cranes, wrecking cranes, gantry, cantilever, pillar and jib cranes; derricks and dredges, hoisting and conveying plants, clam shell buckets, transfer and turntables, locomotive coaling stations, railroad pile drivers, concrete mixers, elevating and conveying machinery, mine surface equipment and structural steel work.

Machine Tools.—A catalogue bearing the title "Twentieth Century Machine Tools," is being distributed by the B. F. Barnes Company, Rockford, Ill. Brief descriptive illustrations and specifications of the various machine tools made by this company, including upright drills, horizontal drilling and tapping machines, gang drills, small screw cutting lathes, key seating punches and water tool grinders are given.

Seamless Cold-Drawn Steel.—A neatly illustrated pamphlet issued by Janney, Steinmetz & Co., Philadelphia, Pa., contains illustrations and descriptions of various applications of seamless cold-drawn steel, including high-pressure reservoirs, boiler shells, domes, tanks, tubes, cylinders and special shapes.

Electric Hoists.—"Electric Hoisting Machinery" is the title of the latest bulletin issude by the Crocker-Wheeler Company, Ampere, N. J. Illustrations and descriptions of various types of electric hoists, winches, capstans, etc., are shown, and their weights, dimensions and capacities are given.

Direct Current Motors.—Detailed descriptions and illustrations of the Sprague Electric Company's Type D d. c. motors are given in its Bulletin No. 224. A brief description of these motors was printed in the RAILROAD GAZETTE of December 29, 1905.

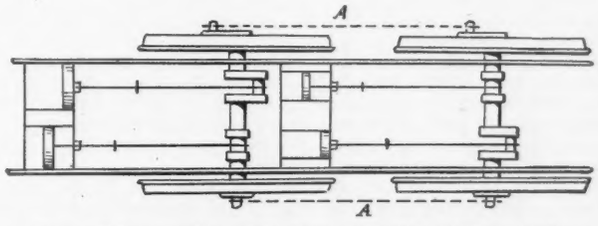
CONTRIBUTIONS

The Origin of Four-Cylinder Balanced Compound Locomotives.

Bristol, England, Jan. 3, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In my contribution under the above heading in your issue of December 8 last I described the first applications of two different systems of four-cylinder compound locomotives—the one with the motor stresses balanced on one driving axle and the other with the motor stresses balanced between two pairs of driving axles through the intermediary of side-rods. Therein it was shown that the French P. L. M. lines, under M. Henry, were the first to make the application of the latter system—that is, the one necessitating side rods for the free balancing or synchronizing of the efforts upon two pairs of wheels. It was also mentioned that Dawes,



Plan of Locomotive with Two Separate Driving Axles.

First proposed by Dawes in 1872. A. Mallet was the first to suggest the use of the rods AA in 1877.

in his patent of 1872, proposed for the first time, and for one of his locomotive arrangements, a locomotive with two, *unconnected*, driving axles. This disuse of side rods, in one form of locomotive mentioned, met the want for an engine in which this wheel-connection, and its several notable inconveniences, were suppressed. An engine in which there are four cranks to one pair of wheels, and divided at 90 deg., is as well balanced in its efforts as modern practice can effect, and is applicable to one driving or any number of connected axles without the side rods playing any essential part in the balancing, whether they are applied or not applied, and this, it may be presumed, satisfied Dawes that he covered, in his three proposed types, all possible desiderata in locomotive design. But he did not (and expressly so) "couple" the wheels in that case where these were driven from two distinct sets of engines. The first engineer to publish the proposal for connecting up the wheels of such engines (having two motor axles) was Mr. A. Mallet—which important fact I failed to note in the article in question and which (as engines of this type have been built largely, especially in France) merits notice as an addition or erratum thereto. It is contained on page 958 of the proceedings of the Société des Ingé-

niéurs Civils, Paris, 1877, as follows: "Four cylinders, of which two high-pressure and two low-pressure, each cylinder with its own driving rods. These four cylinders may be connected to the same axle, and in this case by keying the cranks of each group" (that is on the same side of the machine) "at 180 deg., a very satisfactory balancing of the driving axle may be realized—as already effected by Randolph & Elder in marine engines. Or, each group of cylinders may be connected to a separate axle, these axles being coupled or not coupled; in the latter case this would be a Meyer or Fairlie engine, but working compound; and the complication of the arrangement would be justified both by the principle and by the system of the machines, that is, flexibility, and by the superior working, as a steam engine properly so-called."

The subjoined sketch represents the idea emitted by Mr. Mallet for "coupling" rods applied to a compound engine of any arrangement suggested up to that period (1877). Mr. Von Borries referred to this proposed arrangement for coupling the wheels in his paper read at the Chicago (1903) Engineering Congress, and published on page 1,183 in Vol. 14 of the transactions of the American Society of Civil Engineers as follows: "The arrangement of working one set of drivers by a pair of h.p. cylinders and another by a pair of l.p. cylinders, the two sets of drivers being coupled or not, placed in the same rigid frames, or in two articulated frames, was first mentioned in Mr. Mallet's paper of 1877, page 958; and therefore these engines should be classed under the head of Mr. Mallet's system."

CHARLES B. KING.

Massachusetts Railroad Commission's Annual Report.*†

Changes in law.—A number of changes in the law governing steam railroad and street railway companies, which would ordinarily have been suggested in this report, have been called to the attention of the joint recess committee of the Legislature, which has been reviewing these statutes. A discussion of these changes at this time, therefore, is rendered unnecessary.

Boston Elevated Railway.—The commendable features in the management of the Boston Elevated railway would undoubtedly receive favorable criticism that is now withheld, were it not for the crowding of stations and of cars at certain hours in the morning and evening. While the company during the year has brought into use more cars and trains, added to its force of employees, made changes at stations and introduced the change to side doors at the ends of cars, the public must await the completion of the Washington street subway, now being constructed in a manner that challenges the admiration of those interested in such work; the building of the extension to Forest Hills, with accompanying changes in stations; and the abolition of the Dudley street railroad crossing, for which the Board has recently approved plans, before the running of longer trains and a greater freedom in distribution of traffic will effectually relieve the still present evil of over-crowding.

Financial outlook for street railway companies.—In our last report attention was called to the unsatisfactory showing by street railway companies in their annual returns. The returns of the year that has just closed exhibit some improvement, but the fact remains that unwise promotion, increase in cost of operation and the sins of past managements in paying dividends with earnings that ought to have been used in renewal of properties, make the task of placing many of these railways upon a prosperous footing a difficult and tedious one.

There have been here and there increases in fares. Some of these, when reviewed by the Board, upon complaint of communities affected, have been approved, some approved in part, others disapproved. As predicted, increase in cost of travel has resulted not infrequently in such decrease of patronage as to make the change unprofitable as well as unpopular. Upon the whole, however, there seems to be promise that companies under wise management will in time realize a reasonable return upon investment. The present heavy burden of reconstruction will doubtless afford the foundation for future profitable operation, and tend to create a permanent dividend paying basis. A management that recognizes this should be supported by stockholders for selfish reasons.

South terminal.—During the severe weather of last winter the running of trains through the South terminal yard was on several occasions interrupted. When, however, the number of trains is taken into account, the record seems to entitle the management to congratulation upon its success rather than censure for its failure. Comparison with results obtained at other large terminals makes the showing under the circumstances an exceptional one; but review and criticism of methods is profitable.

Among the devices suggested for the prevention of delays occasioned by storms and severe weather were the roofing over of the yard, the installation of oil or electric heating plants, or the construction of a system of snow pits beneath the tracks. Any one of these plans would introduce a remedy worse than the disease. We are satisfied that the present practice is altogether the best as well as the simplest one—that of employing men to keep tracks and switches free from snow and ice. When occasion demands, a larger force of men should be employed, and greater pains taken to notify the public as promptly and as fully as possible of the causes and the probable length of delays, even though the statement must be an indefinite one. Nothing provokes complaint more than apparent indifference to patrons who are left not only without expected accommodations, but without knowledge as to whether such accommodation is likely to be available, or whether they must look elsewhere for a way to reach home. More effort should be made to give what information is at hand to people who are waiting to take trains that are delayed; and this information should be given in a manner that does not imply that questions ought not to be asked.

Lighting of cars.—Complaint has been made that suburban trains are not properly lighted. There is enough of reason for complaint to lead us to make the recommendation that the management of every company take steps to have cars used in this service so lighted that passengers who desire to read may have the opportunity.

Vestibules of street cars.—The practice of locking from the outside the door leading from the body into the front vestibule of street cars was recently criticized in an order of the Board. This practice had been adopted by companies in the effort to prevent passengers from occupying the front vestibule. To meet the objection to the present method of locking doors, it is proposed to adopt some device which will enable the conductor as well as the motorman to open them. In our opinion legislation, which would make the violation of a proper rule for the protection of motormen a criminal offence, would be desirable in the interest of safety.

Accidents.—. . . The first of a group of recent accidents occurred upon the Worcester & Southbridge street railway. An attempt, as the result of an understanding between the despatcher and the motorman, to make connection between a special car sent out late at night and a regular car upon another railway, was the underlying cause of reckless speed in approaching a sharp curve. In approaching sharp curves at the foot of heavy grades, street cars should always come to an absolute stop, at a point indicated by the maintenance of a stop sign.

The second accident of the group was the explosion of a locomotive boiler upon the New York, New Haven & Hartford Railroad. Fortunately no one was injured. An examination of the boiler after the explosion showed a giving way under steam pressure at a point where the boiler was weakest. This was one of four engines of the same type purchased of a reputable manufacturer in 1889. One of these, on the Plymouth division, adjusted to a pressure of 150 lbs., exploded. The safety valve was adjusted at the time to the pressure of 149 lbs. Nothing was found which pointed to any leak, crack or defect that could have given warning of the danger in any ordinary inspection. In the opinion of the Board the strain upon boilers with such a history ought to have been lessened unless some special test had justified it. When a difference of opinion between experts involves the taking of a possible risk, there ought to be some one with absolute authority to insist upon safety at the expense of every other consideration.

A third accident of most unusual character took place upon the Boston Elevated Railway. [A derailment was caused by a loose switch, loosened by the breakage of a pinion in a motor.] One prominent factor in keeping the train upon the structure and preventing loss of life is found, we believe, in the type of construction. If there had been here the solid floor often advocated in the interest of quieter operation, it is altogether likely that in rounding the curve the cars would have been thrown into the street. Tied together as it was, the existing structure offered a resistance which a railway with solid flooring would not have given.

In approving a construction similar to this for the extension of the elevated railway to Forest Hills, against the objection of those who urged a solid floor, the action of the Board was based upon the belief that in our climate this form of structure is safest. Its strength as proved in this test adds another to the reasons which seem to justify the selection. The fourth, and most important of this group of accidents, is that which occurred within a few weeks at Baker Bridge. [*Railroad Gazette*, Dec. 1, 8, 15, 22.]

The engineer upon the pilot engine of the express train states that he saw the green lights at Lincoln crossing and at Lincoln station, the red fusee just west of Lincoln station and that east of Baker Bridge, and that he knew the meaning of these lights and the rules governing them. He claims that upon seeing the red fusee near Lincoln station he shut off steam. With reference to the use of brakes, his statement is vague, involving at most a claim that he made a slight use of the brake and reduced speed a little. The engineer of the second engine of the express states that in his judgment the brakes were not used, and that the speed was not slackened. That the train proceeded from Lincoln to within a few hundred feet of the place of accident at high speed, with little or no appreciable slowing down, is proved by abundant testi-

*From thirty-seventh annual report of the Railroad Commissioners of Massachusetts—Jas. F. Jackson, Geo. W. Bishop and Clinton White.

†See also page 59.

mony as well as indicated by the impact of the blow in collision. The engineer of the pilot engine of the express further states that he took the train out voluntarily after notice, at 11 o'clock in the forenoon, that he was next on the list to go on duty and a further notice at 4 o'clock in the afternoon that he was assigned to this train; that he felt competent to take the train and was in good condition notwithstanding a headache of which he spoke to nobody; that the night was clear and his view of the track, which runs here in a straight line, seemed unobstructed; that the engine was working well and nothing happened to divert his attention; that it was not until he was within 100 yards that he saw the rear-end lights of the train in front of him and at once applied the emergency brake. As the fireman was immediately killed there is no one to give any other version of what took place in the cab.

. . . However disposed one may be to treat generously a man of previous good record, and one of a body of men to whose splendid fidelity and courage the public owe so much, it would be unjust to those whose lives were in the care of this engineer to overlook his failure in the performance of duty.

It was the practice upon the Boston & Maine to assign trainmen to extra or special duty in accordance with the understanding that the first man to report after the performance of a tour of duty shall be first on the list for the next tour. The engineer assigned to the Montreal express upon the night in question was the man to whom the assignment fell by this understanding. Much of the criticism founded upon the fact that so many of the crew of the express train were spare men rests upon a misapprehension of what that phrase means. A spare man is one who is qualified for, but not yet assigned to, regular service. As there are fewer trains upon Sunday than upon other days, and so many men prefer Sunday as the day to be off duty, the train service of that day is one to which spare men are very generally assigned. It by no means follows that they are not men of experience and ability. Every spare engineer has served his term as fireman and has passed written and oral examinations and ought to be equipped with all knowledge that can be acquired previous to actual practice. Although opinions differ as to the kind of work which had best be first given to a new man, it would seem fairer to him and better for all concerned that he have preliminary experience at a less responsible post before he is assigned to the most important trains. Where expert skill in the grasp of a situation, cool judgment in action and sure control of engine are especially needed, a man new to the work is ordinarily not the one to best meet requirements.

The mere fact that the engineer assigned to the Montreal express was a spare man in no way prejudices him or the company. As to his experience, it seems that he was familiar with the road and had served a long term as fireman upon the engine of an express train, where it was a part of his duty to look out for signals and where he would become more or less familiar with the handling of engine and train. His actual practice as engineer was limited, being confined to a little more than a month in charge of a night switcher in the yard, five days in charge of a freight train upon the road and one day in charge of a passenger train.

Hours of labor on railroads ought to be regulated, but in our opinion this should be done through agreement between employer and employees, and not by statute. Such an agreement is better suited to railroad service, where emergencies, in case of storms, washouts, accidents, and other temporarily unusual conditions demand a reasonable amount of extra work and an elasticity in the regulation of labor incompatible with a statute rule.

There was an agreement of this kind between the Boston & Maine and its employees, but the record shows that the agreement was not always enforced, apparently through a mutual understanding that it might be at times disregarded. In this case the engineer assigned to the express had worked beyond ordinary limits during the week, but a night of sleep and a day of rest had intervened between his employment of Saturday and that of Sunday night, and nothing that he said and nothing that he did gave intimation that his condition was physically or mentally in any degree impaired.

Whether or not the work of the preceding week had any remote connection with what happened on this Sunday night, such instances as these show the advantage of a rigid enforcement of some general rule limiting hours of labor, and permitting exceptions only in such cases as are named in the rule and involve no risk of life. The human factor plays so large a part in all questions of safety in travel, even upon railroads equipped with the most modern devices, that it is of great importance that the assignment of men should be carefully safeguarded. A man cannot be vigorous and alert and watchful without proper hours of rest. We are convinced that railroad employees do not desire legislation to fix hours of labor upon railroads, and we believe that such legislation under present conditions would be unwise. It will be warranted only when the desire of employees to work overtime and the inclination of employers to profit by such work practically destroys any limitation upon the hours of labor under an agreement of parties. [The Board holds that a fusee should be red and be a stop signal.]. . . . Nor is there any likelihood that serious interruptions of service would follow if engineers were required to stop their trains on approaching red fusees. With other safeguards, such a rule should work well. Red fusees can be used too freely, and so lose their significance and value. They had better be used less and mean more.

Rule 99 reads: "When a train stops or is delayed under circumstances in which it may be overtaken by a following train, the flagman must go back," etc. The superintendent stated that under this rule no flagman would be sent back unless something out of the usual course, such as a breakdown or extraordinary delay, had occurred, and this was evidently the way in which the rule was interpreted by those in charge of the accommodation train and by employees generally, if the statement of one of many engineers be excepted. But a delay that has held a train back almost to or quite upon the time of a following train would be within the literal wording of the rule.

Rule 703 reads: "Enginemen must never run past a red signal displayed on the track." . . . In practice this rule does not apply to red fusees, and that it is not intended to apply to them is apparent from a reading of the whole code. But why should a red fusee be classified as any other than a danger signal?

Railroad rules are too often uncertain and inconsistent. Changes are needed to make them more effective, and to bring about harmony in understanding and practice. Colors should uniformly mean the same thing, and we believe that red should invariably mean danger and that trains stop before proceeding further. Results of experience in the use of colors lead us to suggest that green indicate safety, and yellow, if used, caution.

Recent accidents within and without the state emphasize the paramount importance of the enforcement of discipline. One undivided authority to be obeyed without questioning is indispensable to safety, and any agreement or understanding which transfers this authority from employer to employee in matters affecting the safe operation of a railroad is vicious. Though a man be ready to work beyond his physical strength, tempted by the opportunity to earn extra wages, or ambitious to undertake a service for the safe performance of which greater experience or different qualities are requisite, the responsibility for permitting this must rest with the management, and the right to prevent it surely belongs with the responsibility.

Block signals.—The public has the right to expect that a management will adopt every measure of precaution which ought to commend itself to men of expert ability in the operation of railroads. Not that it should heed every suggestion from theorists or men commercially or otherwise interested in promoting patents, but that it should study questions of safety in the light of all available information and without reference to questions of economy. No company has the right to be content with methods and instrumentalities of the past or present, and not keep a look-out for improvements in mechanical and electrical devices that serve to aid and strengthen human agencies.

The experience of many years upon the Boston & Maine undoubtedly led the management to believe that the rules governing fusees and green signals furnished adequate protection against such collisions as that at Baker Bridge. In defence of that belief it must be admitted that if these rules had been followed there would have been no accident at that place. But the rules left too much discretion and responsibility with the train hands.

Although the company has favored the use of block signals under certain conditions, it had not generally replaced the time system of signals with the block system. In our opinion the latter is so far the better system that whatever the policy of the past may have been, that of the future ought to be one which shall vigorously push forward the installation of block systems of the most approved types.

The day for discussion as to whether signals founded upon a division of railroads into blocks are a desirable safeguard is past, experiment having conclusively proved their value. Obviously, no arrangement of mechanical devices yet invented can insure against accident. It is unnecessary to enumerate the many instances in different sections of the country where block signals have failed to prevent accident. And yet beyond question companies ought to have their important lines equipped with them. Block signals give an engineer more definite knowledge of conditions immediately ahead of him, and, in limiting the field of his responsibility, decrease the chances of accident. While failure to observe these signals is always possible, the likelihood of collisions is undoubtedly lessened by their use. The block signal has been introduced to a varying but insufficient extent upon our railroads. We believe it should be generally installed where trains follow each other in quick succession or meet each other at frequent intervals. This suggestion applies as well to street railways where cars are run at high speed.

We recommend legislation requiring railroad companies, and such street railway companies as run cars under similar conditions, to equip, within a reasonable time, lines of the character above named with a block signal of such type and installed in such manner as the Board may approve.

Heavy Eight-Wheeled Passenger Locomotive for the Central R. R. of New Jersey.

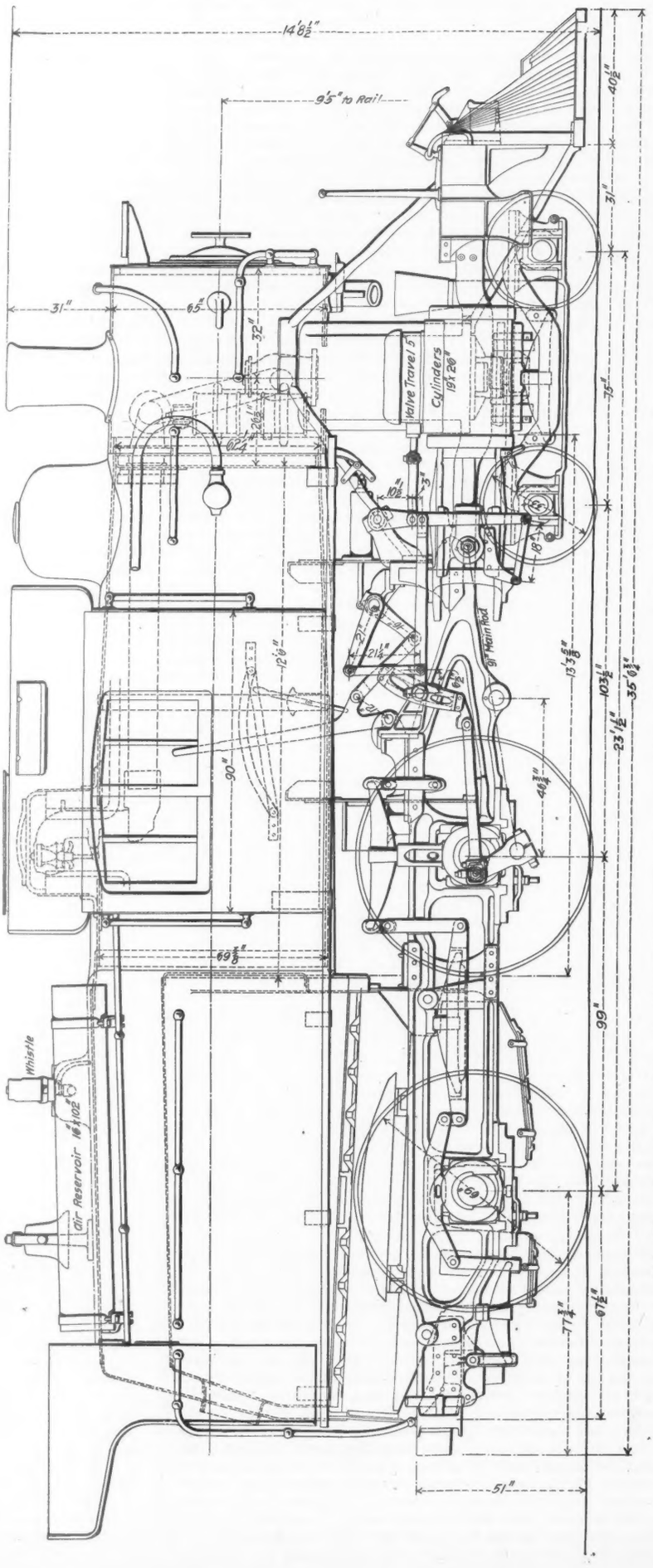
The American Locomotive Co. has recently delivered to the Central Railroad of New Jersey, from its Brooks Works at Dunkirk, New York, three exceedingly heavy locomotives for passenger service. They are of the eight-wheeled American, or 4-4-0 type, and are interesting in part from the fact that comparatively few large engines of this character are now being built for the railroads of the United States. They were designed for hauling a comparatively light train over a very crooked division where the grades are heavy and where the work had previously been done by engines of the ten-wheeled (4-6-0) class. The eight-wheeled engine has been adopted for this work because of the excessive repair charges incurred by the ten-wheeled type on account of the sharp curves.

The work that they are intended to perform is the hauling of passenger trains consisting of one combination car, one coach and one Pullman car, having a total weight of 134 tons without passengers or baggage, between Bethlehem and Scranton, a distance of 105 miles. This is a difficult division because of the grades and frequent stops. In it the track rises 1,394 ft. in 67 miles of continuous up grade, the steepest portions of which range from 37 ft. to 62 ft. per mile. On the other side of the same hill going down into Wilkes-Barre the heaviest grade is 95 ft. per mile. The locomotives are expected to run the 105 miles at an average speed of about 30 miles per hour, with allowances on the time card for a maximum number of 36 stops, many of which are flag stops. Out of the 36 about 15 flag stops and seven regular stops are made every day. These figures apply to train No. 23, which is the most severe of the four trains which the engines are to haul.

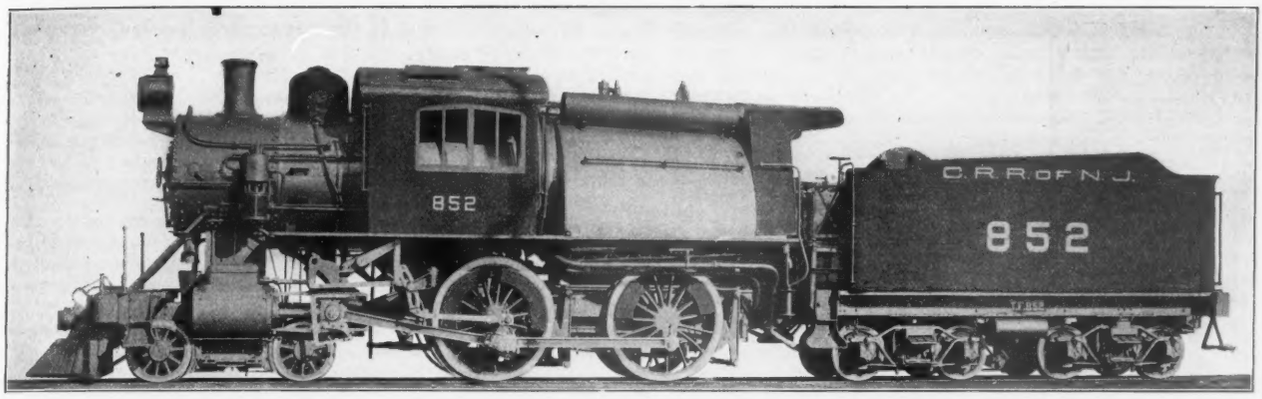
These locomotives were designed under the direction of William McIntosh, Superintendent of Motive Power, and B. P. Flory, Mechanical Engineer of the Central Railroad of New Jersey. They are fitted with the Walschaert mechanism, the arrangement of which is in accord with the regular practice, but it is interesting to note how the details have been worked out to adjust it to working with the cab set forward as in the case of these engines with Wooten boilers. The radius arm and combination lever are attached to an outer rocker arm that hangs down and through which, with a similar arm, the motion is carried to the valve stem. The lifting arm is turned back and the reach rod is a short inclined connection extending from a projection on the reverse lever to the lifting shaft lever, and is but 24 in. long.

The frame of this engine is of cast-steel made in one piece, and is of I section back of the union of the single front rail with the double rail construction just in front of the front driving wheel pedestal. At the cylinders the frame has a width of 5 in. and a depth of 6½ in., by which it is expected that ample strength will be furnished for the stresses that will be imposed. The cylinders are bolted to the frames by seven 1⅜-in. horizontal bolts that are staggered and two vertical bolts near the ends. The guides are carried by a cast-steel yoke of substantial proportions and have an overhang of about 5 in. to the rear.

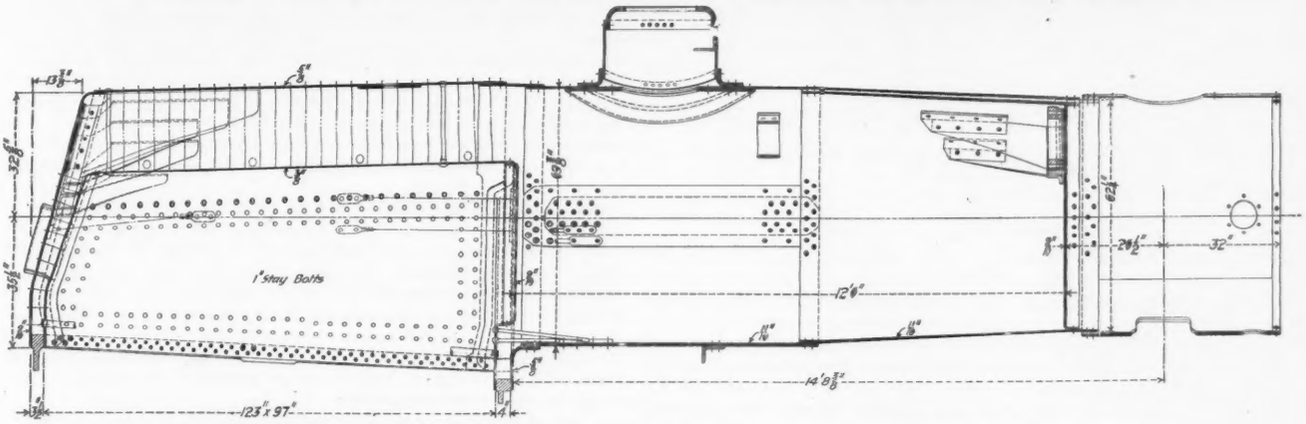
In the paper read before the Western Ry. Club by Mr. Wells, an abstract of which appears on another page of this issue, it was maintained that it would be bad practice to place the injector check less than 24 in. from the front tube-sheet on account of the tendency to cause tube leakages at the front if it were made less. Here, however, we find



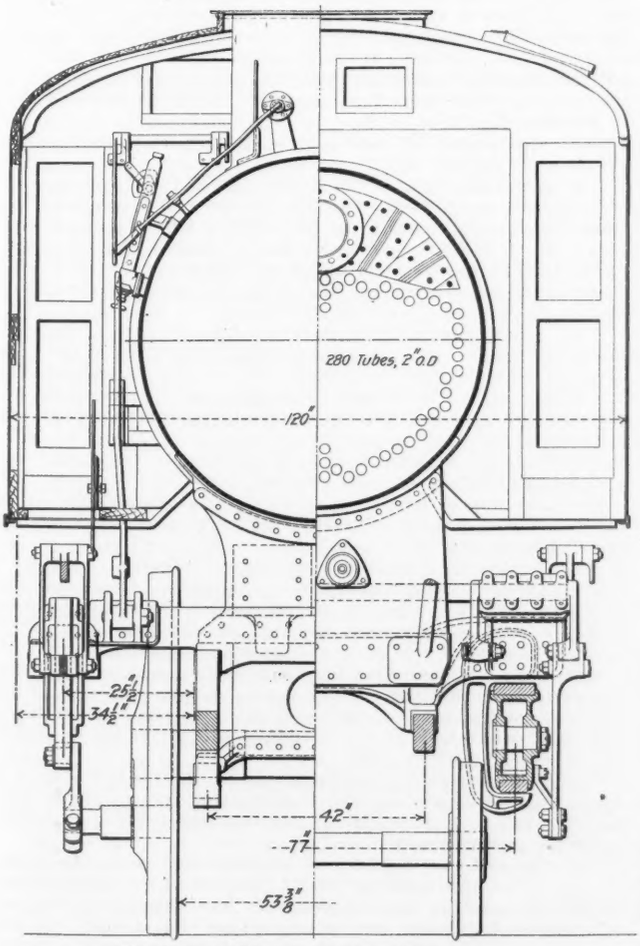
Side Elevation of American (4-4-0) Type Locomotive with Walschaert Valve Gear—Central Railroad of New Jersey.



American (4-4-0) Type Locomotive with Walschaert Valve Gear—Central Railroad of New Jersey.



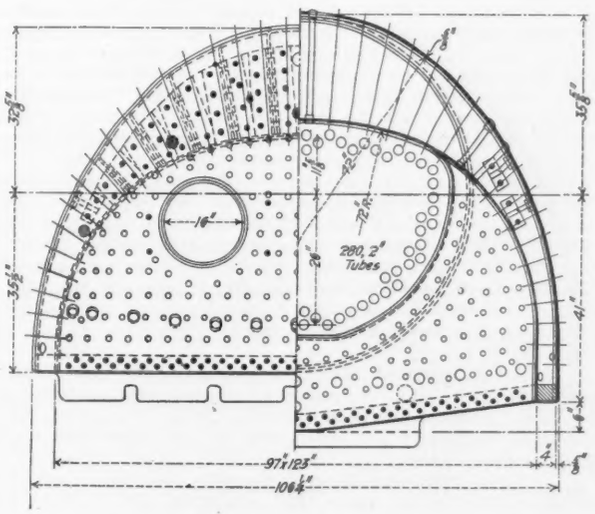
Longitudinal Section Through Boiler of American (4-4-0) Type Locomotive—C. R. R. of N. J.



Half Cross-Sections Through Boiler.

this check located but 8¼ in. back of the tube-sheet, and that where the run is heavy. It will be interesting to note whether front leakages will develop as the result of this or not.

The boiler is of the Wooten type, with a shallow combustion chamber and a long firebox. The back head is sloping with an increase in the width of the water leg from 3½ in. at the bottom to 6 in. at the top. Water grates are used spaced 8¼ in. apart from center to center. These are screwed into the front sheet and



Cross Section of Boiler.

secured with a copper ferrule and beading at the back. The boiler is carried by four buckle plates of the usual character back of the cylinders, two of them being located at the front and back of the firebox respectively. The front course of the shell is conical so that the latter increases from a diameter of 63 in. at the smokebox to 69⅝ in. at the dome.

The general dimensions of these engines will show that they are

among the heaviest of this type that have been built. They are as follows:

Cylinder diameter	19 in.
Piston stroke	26 "
Tractive power	23,120 lbs.
Wheel base driving	8 ft. 3 in.
" total	23 " 1½ "
" engine and tender	49 " 2 "
Weight in working order	158,000 lbs.
" on drivers	108,000 "
" engine and tender	283,500 "
Heating surface, tubes	1,838.1 sq. ft.
" " firebox	167.6 "
" " total	2,005.7 "
Grate area	81.6 "
Axle diameter, driving journals	9 in.
" length, driving journals	13 "
" diameter, truck journals	6 "
" length truck journals	12 "
Boiler, type	Wagon Top
" outside diameter, first ring	62¼ in.
" working pressure	200 lbs.
" fuel	Fine, anthracite coal
Firebox, type	Wide
" length	122⅛ in.
" width	96¼ "
" thickness, crown	⅜ "
" side and back sheets	⅜ "
" thickness, tube sheets	9-16 and ½ "
" water space, front and sides	4 "
" water space, back	3½ "
" crown, staying	Radial, 1⅛ "
Tubes, diameter	2 "
" length	12 ft. 6 "
" number	280
Piston rod, diameter	3¾ in.
Smokestack, diameter	15 in. & 16½ "
Smokestack, above rail	14 ft. 8½ "
Tank, style	Water bottom
" capacity, water	5,000 gals.
" capacity, fuel	12 tons.
Valves, type	Slide
" travel	5 in.
" lap	1 "
" exhaust clearance	1-16 "
" lead	¼ "
Wheels, diameter, drivers	69 "
" " front truck	33 "
" " tender	33 "

The engine is equipped with the Westinghouse-American driver and truck brakes, and the firebox is fitted with water grates in accordance with the practice on anthracite coal burning engines, and as shown in the illustration of the boiler. In comparing this engine with the corresponding engine used on the Delaware, Lackawanna & Western, illustrated in the *Railroad Gazette* Oct. 13, 1905, it will be seen that while the latter has the larger cylinders (20 in.) this Central engine is the heavier. The Lackawanna locomotive weighs 153,100 lbs. when fitted with a superheater, of which 101,000 lbs. are on the driving wheels. The heating surface is less by 133 sq. ft. on the Central engine than the Lackawanna without the superheater, and 178 sq. ft. more than the same locomotive with the superheater. In brief, the two engines are very much alike with the natural variations of weights and design that invariably occur when two independent designs are set up to accomplish similar or comparative results.

Working of Harriman Lines' Equipment Clearing House.

An equipment clearing house was on June 1, 1904, established by the Union Pacific System and the Southern Pacific Company (Pacific System), including the Union Pacific, Oregon Short Line, Oregon Railroad & Navigation Company and all Southern Pacific lines in the United States west of El Paso, Tex. Under this arrangement cars of all the lines associated in interest are used without distinction by each. Its effect is to largely reduce the movement of empty cars consequent upon the former practice of returning cars to the owning road, to do away with expenses at junction points, and to add considerably to the available equipment in any of the territory where the demand for cars may become excessive. For comparison with the rules under which the New York Central Lines' freight car repair pool, described in the *Railroad Gazette* of June 16, 1905, page 705, is operated, the most important sections of circular No. 5 issued on May 1st last, by the accounting department of the Harriman Lines involved, are given herewith.

1. By authority of Mr. J. Kruttschnitt, Director of Maintenance and Operation, for reasons of economy and convenience, an Equipment Clearing House in connection with the operation of rolling stock equipment was established by the lines named above, effective June 1, 1904.

2. Locomotives and cars of clearing house lines will be assigned to the lines on which they can at the time be used to the best advantage.

3. Repairs required by locomotives or cars of clearing house lines to put or keep them in serviceable condition may be made by any shop on any of these lines.

4. Inspection to determine responsibility for repairs will not be required of locomotives or cars passing from one clearing house line to another, except only in the case of passenger cars belonging to foreign roads—that is, to roads other than the clearing house lines.

5. Per diem charges for the use of equipment have been discontinued between clearing house lines, and rental charges based on mileage will be paid by the line using to the line owning equipment, as follows:

	Cents per mile—Freight service.	Cents per mile—Passenger service.
Locomotives:		
Consolidation, 12-wheel, Pacific type	17	11
Mogul, 10-wheel, Atlantic type	15	10
All other locomotives	13	9
Passenger cars:		
Coaches, composite cars and dining cars	..	3
Baggage, mail and express cars	..	2
Freight cars	0.6	..

The rates for locomotives in freight service will apply also to switching, work and construction service; the mileage to be calculated on the usual basis, viz.: actual mileage under running orders, and an allowance of six miles per hour for time employed at a certain point or within certain working limits.

6. Separate reports will be made of locomotive mileage and car mileage.

7. Settlement for locomotive and car mileage will be made by draft.

8. The cost of repairs to locomotives and passenger cars of clearing house lines or of foreign roads, occasioned by accident, will be borne by the line on which the accident occurs. It is assumed that accident damages to passenger cars, if of any magnitude, will be repaired by the line responsible therefor. If, however, a passenger car belonging to a clearing house line is damaged by accident on a clearing house line and is accepted by another clearing house line, or by a foreign line, as safe to run, repairs made after such acceptance will be classed as ordinary, not as accident, and will be charged (or recharged) to the owner, in accordance with Section 10 hereof.

9. All repairs (except accident repairs) to locomotives of the clearing house lines will be charged to the owning line, on the basis of actual cost. By "actual cost" is meant store department prices for material plus the usual percentage for store department expense and the actual cost of labor employed, plus the usual percentage for "dead labor." An addition of 10 per cent. will be made to cover superintendence and "shop expense," which amount will be credited to Account No. 17, repairs and renewals of locomotives. The total cost of labor and of material (separately) should be given for each locomotive.

10. All repairs (except accident repairs) to passenger cars of the clearing house lines will be charged to the owning line, on the basis of M. C. B. prices. If the repairs are made by a foreign road and charged to a clearing house line not the owner of the car, they will be recharged by such line to the owner. This arrangement does not, however, abrogate any existing agreement in respect to repairs to passenger cars in through service over any of the clearing house lines in connection with others of these lines or with foreign roads.

11. Settlements for repairs to locomotives and passenger cars will be made by bill and voucher.

12. The cost of repairs to freight cars of clearing house lines or of foreign roads, when occasioned by accident, fire or wind, and amounting to $75 or more per car, will be borne by the line on which the accident occurred. Repairs to freight cars amounting to less than $75 per car, will not in any case be classed as accident repairs, and will be reported to the clearing house as provided in Section 13.

13. The amount of all expenditures made by each of the clearing house lines, which, according to the classification of operating expenses are chargeable to Account No. 20, repairs and renewals of freight cars, will be charged to the equipment clearing house and reported for apportionment as hereinafter provided, except the following:

a. The cost of repairs due to accident, fire or wind, when amounting to $75 or more for any one car.

b. The cost of temporary coal doors and grain doors, which, being incurred in connection with particular shipments, does not benefit all clearing house lines.

c. Charges for cars sold, worn out or destroyed.

d. Amounts billed against foreign roads for repairs to their cars. That portion of the cost of such repairs which cannot be thus billed out will be included in reports to the clearing house.

e. The cost of repairs to narrow gage freight cars.

14. To cover superintendence and shop expense, each line will charge to the equipment clearing house, and report for apportionment, an amount equal to 10 per cent. of the charges specified in Section 13, which amount will be credited to Account No. 20, repairs and renewals of freight cars.

16. Amounts paid to foreign roads for repairs to freight cars made by them, except accident repairs amounting to $75 or more per car, will be included in the amounts reported to the clearing house for apportionment.

17. Record need not be kept by individual cars or by classes of cars, of repairs made to freight cars owned by clearing house lines, except in the case of steel cars, steel frame cars and certain classes of wooden cars of similar age and capacity, the last mentioned to be designated by the superintendents of motive power; for which each clearing house line will report to the owner, month-

ly, the cost of repairs made to each class. The expense of repairs to these cars will be treated in the accounts in precisely the same way as repairs to other freight cars, that is, as directed in Sections 12 and 13 hereof, these reports being for statistical purposes only, and not for accounting. Each clearing house line will furnish to the general auditor and to the director of maintenance and operation, a monthly statement showing for each of the selected classes of its cars the total actual cost of repairs, the number of cars owned, and the cost per car. Miscellaneous expenses which cannot be located to individual classes of cars, such as wages of inspectors, cost of tools, etc., will not be included.

18. The motive power department of each line will render to the other lines monthly statements of their wheels replaced by it, that reclamation may be made on the wheel manufacturers for amounts due under guarantees of certain performance.

19. Settlements for cars destroyed will be made (by bill and voucher) between clearing house lines in accordance with M. C. B. rules. No portion of destroyed cars belonging to clearing house lines will be returned to the owner, but proper allowance will be made for the value of the entire car. Trucks in serviceable condition, when of common standard, will be used by the retaining line in the construction or reconstruction of its own cars, or reconstruction of cars of any of the clearing house lines; trucks of light capacity will be used for its work-car equipment by the retaining line.

20. The total amount of charges for repairs to freight cars reported to the clearing house as provided in Sections 13 and 14, will be apportioned to the various clearing house lines on the basis of mileage made on such lines by all cars in freight service, including those owned by clearing house lines and those owned by foreign roads. The mileage of roadway cars in freight service should be included, as the repairs due to such mileage are charged to Account No. 20, repairs and renewals of freight cars. The mileage of freight cars in roadway service should be excluded, as the repairs due to such mileage are charged to Account No. 21, repairs and renewals of work cars. The freight car mileage allowed for engines hauled dead in freight trains—also for new passenger cars hauled for other companies in freight trains—should be excluded, as no charges to Account No. 20 accrue from such service. No mileage, actual or constructive, made by cars of clearing house lines on foreign roads will be considered in the apportionment, and such mileage should not be reported to the clearing house.

21. As soon as possible after the close of each month, the net charge to the clearing house, as specified in Sections 13 and 14, and the freight car mileage, as specified in Section 20, for the month, should be telegraphed to this office, where the amount of the expense which should be borne by each line will be determined and announced by wire. Authority will be given at the same time for lines which have paid out more than their proportion of the total repairs to make sight draft on Union Pacific Railroad for the amounts of such excess, and Union Pacific Railroad will make similar drafts for the amounts of deficiency upon the lines which have paid out less than their proportion. Detailed statements of the apportionment will be furnished by mail.

22. The proportions for the various lines of the total freight car repairs as determined by the clearing house apportionment will be disposed of in Account No. 20, repairs and renewals of freight cars.

23. This arrangement applies only to equipment lettered as follows:

a. "Union Pacific R. R."

b. "Oregon Short Line R. R."

c. "Oregon Railroad & Navigation Co." "Oregon Railway & Navigation Co." "O. R. & N. Co." or "O. R. & N." Some of this equipment bears "S. R. V. R. R. Co." in addition to the foregoing.

d. "Southern Pacific Co.—C. P. Ry." "Southern Pacific Co.—S. P. R. R.," or "Southern Pacific Co.—O. & C. R. R."

It does not apply to equipment owned by or assigned to the Sonora Railway, or lines in Louisiana and Texas known as the "Sunset" and "Central" lines. The assigned equipment all bears the name of the road to which it is assigned, though some of it is also lettered "Southern Pacific" in medallion form.

Results from the operation of the clearing house, according to information furnished us by Mr. J. Kruttschnitt, Director of Maintenance and Operation, have been exceedingly satisfactory. The following statement was made in the annual report of the Union Pacific for the last fiscal year:

"The clearing house put into effect this year by the companies for the common use of their rolling stock was an important factor in the excellent results attained by the transportation department. By this clearing house system of distributing cars there was effected an increase of 1.60 cars in the average number of loaded cars per train and also a gain of 1.55 per cent. in the percentage of loaded freight car mileage to total freight car mileage, representing a saving of about 5,726,992 empty car-miles."

Mr. Kruttschnitt supplements these figures by the following table which shows for the last fiscal year results on the Union Pacific System and Southern Pacific Company (Pacific System) separately and for the associated systems together. The statement shows the loaded and empty freight car mileage on the two systems for the year ended June 30th last, during which the clearing house was in effect, as compared with similar figures for the previous year. The statement appears below:

Year ending June 30th.	1905.	1904.	Increase or —decrease—	
	Loaded Freight Car Miles.			
Union Pacific system	269,763,446	240,405,820	Inc. 29,357,626	12%
Southern Pacific Co.	344,926,922	338,783,730	Inc. 6,143,192	2%
Total	614,690,368	579,189,550	Inc. 35,500,818	6%
	Empty Freight Car Miles.			
Union Pacific system	99,719,947	96,008,791	Inc. 3,711,156	4%
Southern Pacific Co.	140,793,852	158,982,665	Dec. 18,188,813	11%
Total	240,513,799	254,991,456	Dec. 14,477,657	6%
Grand total	855,204,167	834,181,006	Inc. 21,023,161	3%
	Ratio Empty Car Mileage.			
Union Pacific system	26.99	28.54	Dec. 1.55	
Southern Pacific Co.	28.99	31.94	Dec. 2.95	
Total	28.12	30.57	Dec. 2.45	

This illustrates in a striking way the great saving which has been made in movement of empty cars, which means, of course, a consequent increased availability of equipment for securing loads. Had the 1904 ratio of empty mileage prevailed in 1905, the empty car mileage would have amounted to 261,435,000 miles, or nearly 21,000,000 freight car miles in excess of the actual figure. This saving is roughly equivalent to 500,000 freight train miles; that is, the 1904 ratio would, with an average of 42 cars to a train, have required the running of 500,000 more freight train miles. Since the close of the fiscal year covered by the table, there has been especial opportunity for efficiency in handling equipment to be shown because of the unusually severe car shortage and the consequent heavy demands on the equipment. In the four months ended Oct. 31, 1905, the ratio of empty car haul was still further reduced 1.15 per cent. on the Union Pacific and 1.19 per cent. on the Southern Pacific; an addition of nearly one-half to the saving in the fiscal year 1904-1905. Results as favorable as these speak for themselves for the success of the equipment clearing house as a measure of operating efficiency.

Massachusetts Railroad Commission's Report.*

The report of this body was sent to the Legislature on January 15. The length of railroad in the state is 2,105 miles. This figure has remained practically unchanged for several years. The usual statistics of operation are given, which, however, include the business on 2,857 miles outside of the state. The ratio of expenses to earnings was 72.19, a fraction less than in the preceding year. Six passengers, 80 employees and 178 other persons were killed on the railroads in the state of Massachusetts during the year, and 49 passengers, 438 employees and 182 other persons were injured. A table is given, showing the casualties since 1895, in which travelers on the highway at grade crossings are separated from trespassers. From this table, it appears that in 10 years the number of trespassers killed (1,305) was 241 larger than the passengers, employees and travelers at crossings combined.

The report of the Bridge Engineer gives the usual statistics. Forty-nine bridges have been built or replaced during the year; 28 wooden spans by 18 wood and 11 metal; 21 metal spans by 21 metal and one stone. The New London Northern (Central Vermont) has replaced with pin connected steel trusses and plate girders the wooden bridge across the Connecticut river at Northfield, which had been in service 56 years, though it had been strengthened several times by the addition of arches.

The length of line now owned by the street railway companies of Massachusetts is 2,220 miles; length of track, 2,777 miles. Only 19 miles of the street railway is outside of the state. The principal statistics of the street railway lines are as follows:

	1905.	1904.
Assets	$151,742,233	$140,843,740
Capital stock	70,326,985	68,542,038
Funded debt	55,780,500	46,674,884
Other liabilities	19,495,757	20,770,564
Total liabilities, incl. sinking f'd, etc.	147,491,778	137,690,872
Surplus	4,250,455	3,152,868
Dividends	3,174,505	3,214,496
Cost, per mile of main track	51,309	50,308
Gross receipts	28,638,252	27,759,334
Expenses, incl. taxes, and all charges	25,081,561	27,761,221
Expenses, including dividends	28,256,066	27,975,717
Surplus for the year	382,186	*216,383
Passengers carried	532,731,017	520,056,511

*Deficit.

The dividends declared averaged 4.51 per cent. on the total capital stock, as against 4.69 per cent. the year before.

Eighteen passengers, 13 employees and 54 other persons were killed on the street railways during the year, and 3,959 passengers, 204 employees and 1,518 other persons were injured. The street railways report 18 additional spans of bridges over last year, and

*See also page 54.

two spans rebuilt. Hereafter the board is not to take account, in its inspection records, of highway bridges over which street railways pass.

Washington Correspondence.

WASHINGTON, Jan. 16.—Railroad rate legislation has not made any progress at either end of the capitol during the past week. It had been expected that the Hepburn bill would be favorably reported from the House Committee on last Friday. The Republican members of the Committee were unanimously agreed upon it, but opposition came from the Democrats, who asked for more time for its consideration. This was granted by the Republican majority and action was postponed for one week. It is not certain that a report will be ordered this week, as Representative Adamson, of Georgia, suggested at the last meeting that some of his constituents would like to be heard on the subject of private freight cars. The fruit growers of Georgia are very much interested in the refrigerator car service with which their fruits and vegetables are hauled to northern markets, and they are practically unanimous in opposing any legislation that might interfere with the present service. They contend that they have better service and that their products reach distant markets in much better condition since the railroads of the south entered into exclusive contracts with the Armour Car Line Company. Whether this hearing is granted or not, the Hepburn bill will sooner or later be reported to the House just as it has been agreed upon by the Republican members of the Committee.

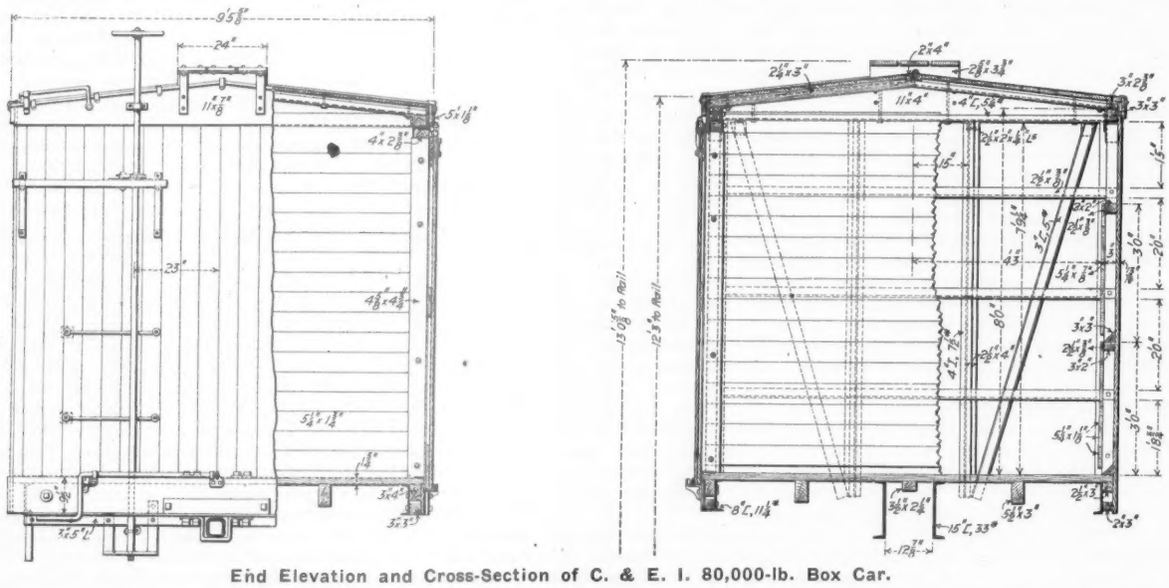
The Senate Committee is not making great progress with the preparation of a compromise bill, but there are frequent informal conferences among the leading Republican Senators with a view to an agreement on a bill that can receive the support of practically all of the Republican Senators. The idea that the question of the reasonableness of a rate or of the legality of a regulation or practice must be passed upon by a regularly constituted court in the first instance is apparently gaining ground in the Senate. Senator Fulton, of Oregon, made a speech to-day in which he indicated that he favored substantially the plan of legislation suggested by Judge Walter C. Noyes, of Connecticut, in his book on "American Railroad Rates," under which the question of the reasonableness of a rate would be passed upon by a court, and then, if the court should find the rate unreasonable, the Commission would proceed to make a rate for the future in harmony with the decision of the court. It will be noted that this is along the line of the compromise plan that Senator Elkins now has in mind, except that Senator Elkins would let the carrier have a try at fixing a substitute rate before having the Commission step in and exercise its final rate-making power. At present the prospects seem to be good of uniting enough of the Republicans on this compromise measure to put it through the Senate even if it should not be possible to obtain for it the support of all the Republican Senators.

When Representative Grosvenor, of Ohio, suggested that Congress might retaliate upon the railroads for cutting off free transportation by reducing the compensation paid for the transportation of the mails it was not generally believed that he could have been in earnest or that any self-respecting member of Congress would take a stand that could only be construed either as an attempt to blackmail the roads into restoring the pass system or as an acknowledgment that Congress has in the past allowed excessive compensation for the railroad mail service in return for free transportation. However this may be, it has developed within the past few days that there has been considerable discussion among the members of the House Committee on Postoffices of the advisability of making a material reduction in the pay for carrying the mails on the railroads of the country. It will be recalled that this subject was gone into very thoroughly some years since by a joint commission of Senators and Representatives, and the conclusion was reached that, taking into consideration all of the exactions of the government and the heavy penalties imposed for failure to carry the mails on time, the compensation received by the roads was none too great. This report was signed by every member of the joint commission except Representative Fleming, of Georgia. Now, however, members of the House Committee are talking of cuts of from 5 to 20 per cent., and some of the representatives of railroad interests here were told to-day that the Committee would probably take the matter up seriously and hear representatives of the Postoffice Department and of the railroads as to the rates of compensation that should be allowed for the railroad mail service.

J. C. W.

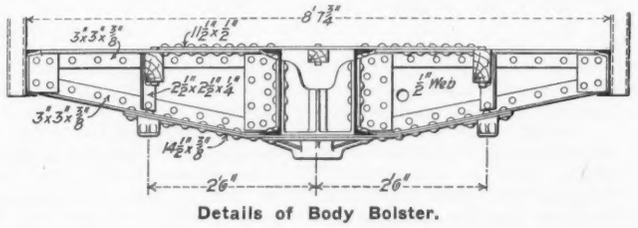
Steel-Frame 80,000-lb. Box Cars for the C. & E. I.

The St. Louis plant of the American Car & Foundry Company is building for the Chicago & Eastern Illinois 750 80,000-lb. box cars with steel underframing and body framing, conforming to American Railway Association standard dimensions. They are quite similar to a design in use by the Norfolk & Western. The underframing consists of two 15-in., 33-lb. channel center sills spaced 12⅞ in. back to back, and 8-in. 11¼-lb. channel side sills. The transverse members between center and side sills are 4-in., 5¼-lb. channels,



End Elevation and Cross-Section of C. & E. I. 80,000-lb. Box Car.

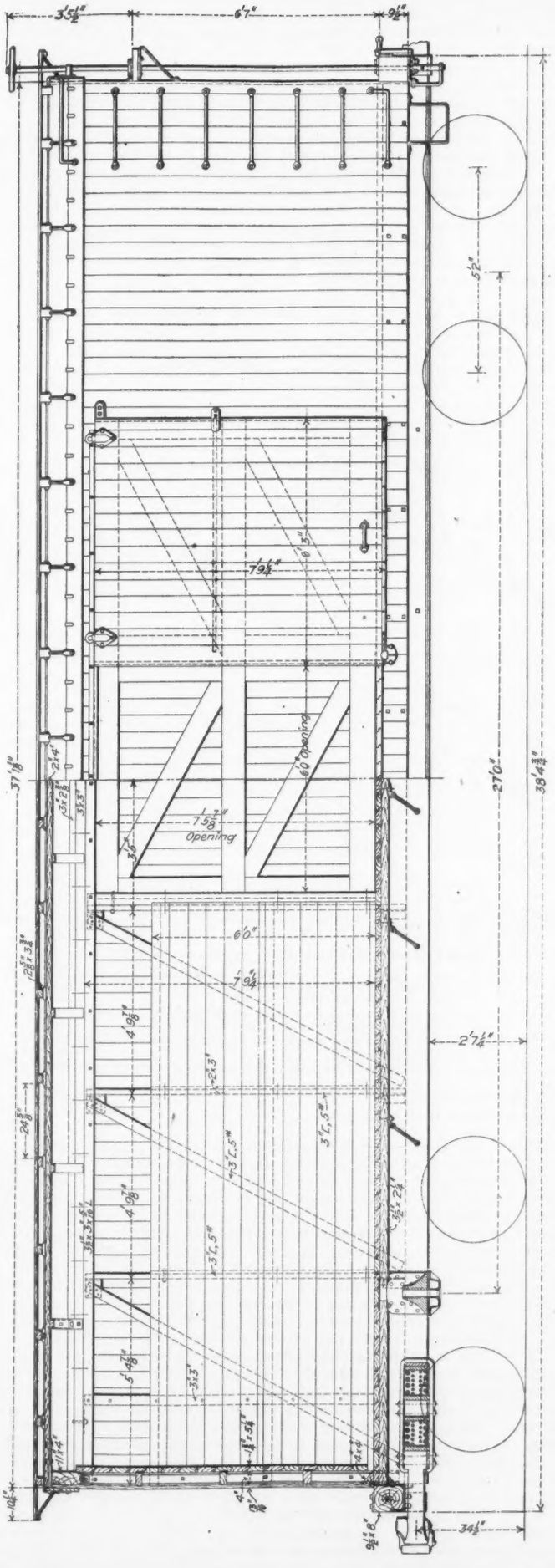
of which there are five on each side between body bolsters. The latter are built up of plates and angles with a steel center casting, as shown by the details. Braces of 6-in. x 3½-in. x ⅜-in. angles extend from near the ends of the center sills to the outer ends of the bolsters. A plate 12½ in. wide, ⅝ in. thick and 8 ft. 7¾ in. long is riveted across the ends of the longitudinal sills and a 5-in. x 3-in. x ½-in. angle at its lower side supports the 8-in. x 9½-in. wooden end sill. A wooden longitudinal nailing sill, 3 in. x 5½ in.,

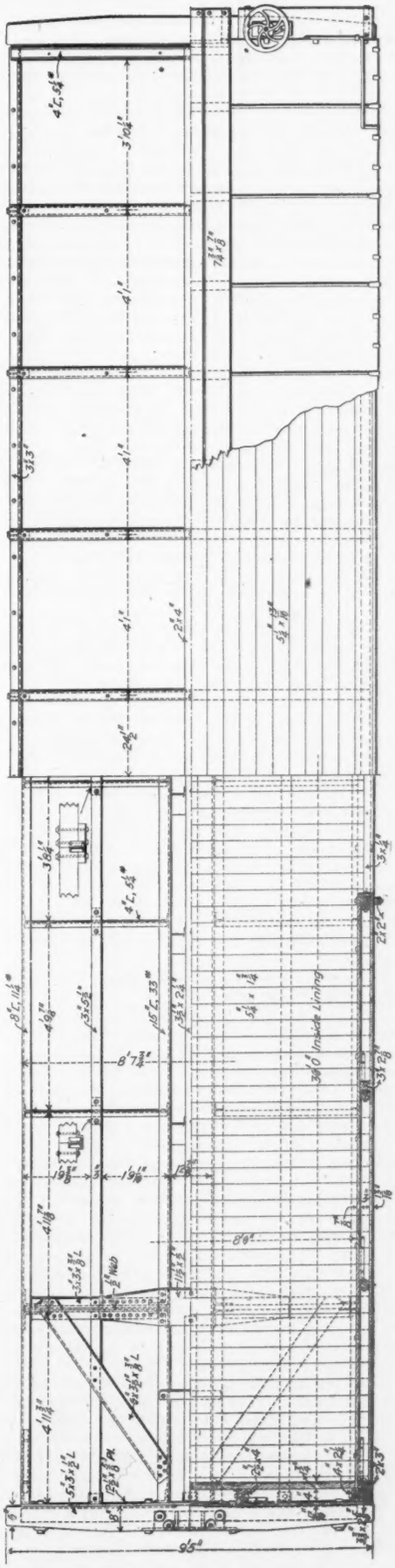


Details of Body Bolster.

is placed between center and side sills on each side and is dapped over the 4-in. transverse channels and secured to them as shown by the details. There is a nailing strip between center sills supported by and bolted to special supports secured to the center sill webs by two transverse ¾-in. bolts each, passing through the webs. To each side sill is bolted an upper and lower wooden nailing strip as shown, those under the doors being of larger dimensions than the others.

The upper framing is composed of channels, angles and I-beams. The end posts are 4-in., 7½-lb. I-beams, the corner posts 4-in. x





80,000-lb Box Car with Steel Underframe and Body Framing—Chicago & Eastern Illinois.

3-in. x ⅜-in. angles, and the side and door posts, the braces and purlins 3-in., 5-lb. channels. The top members are 3½-in. x 3-in. x 5/16-in. angles on the sides and 4-in., 5¼-lb. channels on the ends. The belt rails are 2½-in. x ⅜-in. flat iron. Additional details are well shown by the drawings, for which we are indebted to Mr. W. A. Nettleton, General Superintendent of Motive Power of the Frisco System.

The Care of Boilers.

At the November meeting of the Western Railway Club, Mr. M. E. Wells, the traveling master mechanic of the Wabash, read an interesting paper on the care of boilers. He had begun his investigation with the idea that the majority of tube leaks were caused by abuses in the roundhouse and clinker pit; and, after having formulated certain rules for the care and washing out of engines in these places, was surprised to find that tubes still continued to leak. A further investigation showed that injected feed water had a good deal to do with it. Comparatively cold feed water sinks to the bottom of the boiler, so that the temperature of the water at that point is sometimes 90 degrees lower than it is at the top, as indicated by thermometers placed at various points from above the crownsheet to the foundation ring of the firebox. With an ordinary check and an ordinary boiler, it is impossible to work the injector for half a minute without cooling the bottom of the boiler, no matter how hot the fire may be; though the hotter the fire the less will be the cooling at the bottom.

When the water is going into the boiler at a temperature of about 150 deg., and that is about the average feed-water temperature in the winter, it enters water in the boiler that has a temperature of 388 deg.—238 deg. colder than the water in the boiler—and not one drop of it ever goes above the boiler check. It sinks, at once, down between the flues and the outer shell, and towards the firebox. Tube leaks will be found, in ninety-nine cases out of a hundred, to be below the check, and, although there are some exceptions to the rule, it is the lower tubes that make trouble. This is one of the reasons why it is so objectionable to put on the injector and fill up the boiler while standing at a water tank. The steam gage does not show what is going on. The cold water drops down to the bottom, the hot water remains at the top and maintains the pressure, but, when the throttle is opened and the water is put in circulation, the pressure drops. The engineman who does this will use all the water put in while standing, and sometimes more, before he gets the steam pressure up again and can put the injector on. He would be as well off if he had not used the injector, but had waited until the engine was well started, when it could be put on almost at once.

An examination of the behavior of a boiler in firing up shows the same wide variation of temperatures at the top and the bottom. A diagram has been made from the indications of the thermometers to show this. The results of the first of three tests is shown by the two solid lines. The upper one shows the temperature above the crownsheet and the lower one that at the mudring. They were six degrees apart at the start, but when the fire was lighted the upper one began to rise at once, while it was nearly an hour before the lower one showed any appreciable change of temperature. Even then the pressure was raised with a temperature of 125 deg. between the two points. The second firing, the results of which are shown by the dotted lines, gave about the same indications. In the third case, shown by the broken lines, there was a difference of 135 deg. in temperature at the start, and at the end of an hour and ten minutes this had increased to 140 deg., so that while the top had a temperature equivalent to about 68 lbs. of steam pressure, the bottom stood at about 140 deg.

One of the interesting things shown by the diagram is the effect of putting the blower on. The house blower had been working up to an hour and ten minutes where the diagram is marked "See Note." At this point the house blower was taken off and the engine blower put on, which immediately started the circulation with a consequent simultaneous rise in the bottom temperature. This same effect is shown by the dotted lines of the second test. At the end of two hours and a half there was still a difference of 60 deg. The engine was then moved about 600 ft., which produced circulation enough to bring the temperatures together.

The second diagram shows the effect of cooling after raising steam. Each time the boiler was cooled in a different manner, the best results being obtained by that corresponding to the broken lines. In this there is but 12 deg. difference of temperature. In this particular case, the engine was equipped with a Talmage surface blow-off cock, and all of the cold water was spread uniformly over the top. In the ordinary method, the water goes through the boiler check and a large part of it through the injector throttle. The results so obtained are fair, though not quite as good.

It has been found that in firing up and cooling, the temperature is the same on any horizontal line through the boiler. Around the mudring, for instance, the thermometers would always read the same at any point, and the thermometers at the crown sheet in firing up and cooling down would always read the same. Hundreds of readings were taken, and they were always the same. The variations of boiler temperatures are vertical. The problem to be solved is finding the best method to be adopted to decrease the variations of vertical temperatures.

In firing up it was noted that there was less variation in temperature when the house blower was on than when the boiler was merely allowed to stand. The boiler was warmed more uniformly, which shows that the blower has a good and not a bad effect, as commonly supposed. On the other hand, where the engine blower is used the lines come closer together, showing the benefit of increasing the circulation. The variations decrease from the standing method without a blower, to the house blower and then to the case where the engine blower is used.

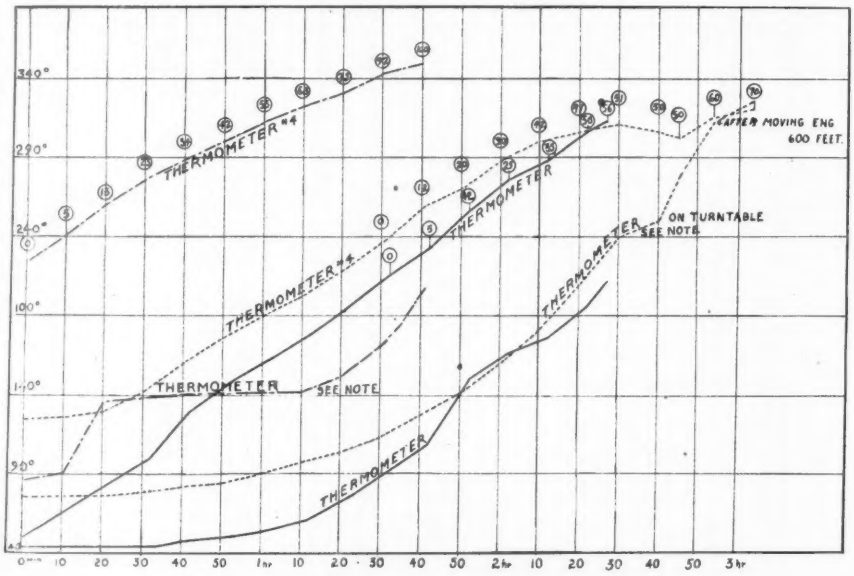


DIAGRAM OF TEMPERATURES TAKEN IN FIRING-UP TESTS.

———— Test No. 4.—Getting Engine Hot. Fire built by spreading 4 inches Coal over grates and building wood fire uniformly on top of Coal, but not as good a fire in front as in back of box.

- - - - - - - - Test No. 5.—Wood fire built on top of a layer of Coal, and close to side and flue sheets. Did not burn good in front.

———— Test No. 6.—Getting Engine Hot. Fire built in back of fire box. No fire in front. Wood in before Coal.

Note.—House blower used in all tests. It is necessary with the fine netting with Sheridan Coal.
Changed from house blower to Engine blower, at the 1 hour and 10 minutes reading, in test No. 6.
Engine taken out of house in test No 5

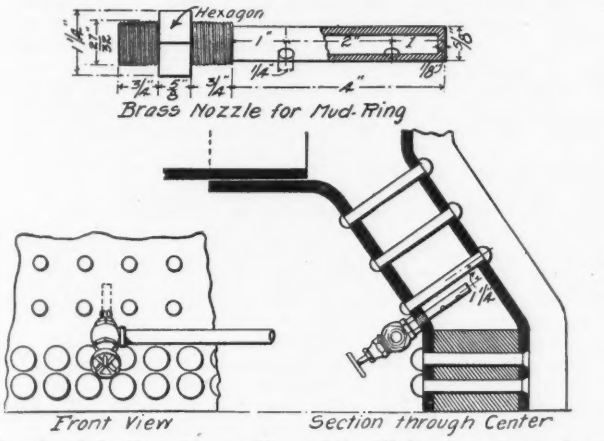
In order to overcome these inequalities, compressed air was introduced at the mudring in order to induce circulation, and with considerable success. In these tests, as shown by the diagrams, the lines of the top and bottom thermometers are quite close together. In fact, the temperatures were practically the same; and this was accomplished by merely introducing a jet of air or steam at the lowest point, by which the boiler was warmed uniformly from the bottom to the top. The illustration shows the arrangement designed by Mr. Wickhorst to introduce either steam or air. Of the two, it is better to use steam, because the air passes through the water and produces a circulation only, whereas the steam not only induces a circulation but heats the water at the same time.

In the first tests that were made, the thermometers were put in on the left side and the left injector was worked. It was afterwards found that the drop was almost twice as great on the side upon which the injector was located as upon the other.

If a boiler goes out of the shop with the tubes uniformly tight, the leakages will appear on the side where the injector is located. Then, if these are tightened, the next leakage may appear on the other side, because the tubes are not uniformly tight. A case occurred on a division where, of two engines in identical services, one gave no trouble and the other a great deal of trouble from leaky tubes in the bottom row. An examination showed that the latter engine was fitted with a deflecting plate just inside the check. This was put in so that the water would not strike the tubes, with

the result that it was turned downward and went directly to the bottom of the boiler, where it affected the lower rows of tubes and caused the leakage.

Another instance of the bad effect produced by filling the boiler when standing was that of a passenger engine that came in from a run of 238 miles with the tubes dry. Thirty minutes afterwards, while standing on the clinker pit, the tubes were leaking badly. The hostler had simply filled the boiler with water so that "she would hold," with the result that, as there was an arch in the firebox, the engine had to be taken to the house and have the arch torn out and all the tubes worked over. This is a good illustration.

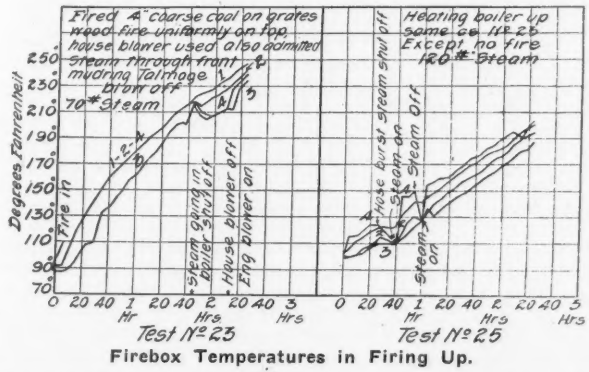


Device for Injecting Air or Steam into Water Leg to Produce Circulation.

The reason why tubes leak at the back and not at the front is explained by the tests made in France by which the evaporative efficiency of the various portions of a boiler was shown. It was shown there that 35 lbs. of water were evaporated per sq. ft. of heating surface per hour at the firebox; that the first quarter of the length of the tubes evaporated 9½ lbs.; that the second quarter evaporated 4½ lbs.; the third quarter 3 lbs., and the last quarter only 2 lbs. This is interesting as indicating where the largest amount of water is evaporated in a boiler, and shows conclusively that all injected water goes to the bottom and towards the firebox. The greater amount of steam being generated in the back end of the boiler compels circulation toward the back end of the tubes and firebox, and this is why the back ends are affected and the front ends are dry.

Forty years ago the boiler check was located near the firebox, but this was found to be so hard on the sheets that it was moved farther and farther forward until it was too close to the front tube-sheet and caused leaks there. It was then moved back a little and so located where it is to-day, so that it should not be nearer the front than 2 ft., although 18 in. may be safe.

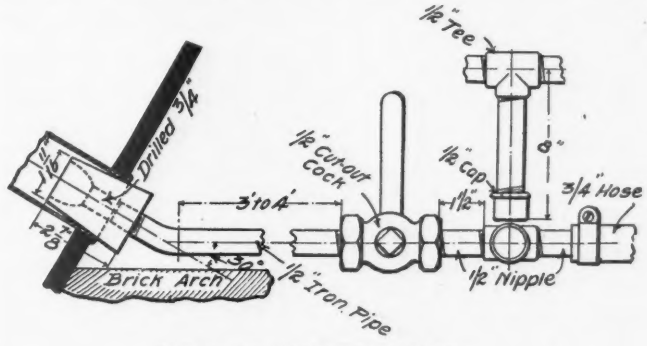
One of the most important things in caring for a boiler is to



Firebox Temperatures in Firing Up.

keep the fires clean and have the heat down close to the mudring; just as close to the grate as possible. In cases where the fire is very dirty and the grates are covered with a thick layer of ashes, all of the water that is put into the boiler goes directly down to the mudring and stays there. It is impossible to heat water below the fire line, except by circulation, and this does not exist when the engine is standing. In this connection, attention is called to the fact that there are more leaky tubes in the winter than in the summer. The feed water goes into the boiler, as a rule, colder in winter time than in summer time. In the summer water goes into the boiler at 200 deg. and over. In the winter it goes into the boiler at 150 deg. and under. This is about the difference between summer and winter conditions. In zero weather it is even worse. The colder the water is when it goes into the boiler the colder it is when it reaches the bottom, and no matter how cold it goes in, it always reaches the bottom first. It is a good practice to heat the feed water a little while it is in the tank. To keep the engine from popping, the steam can be blown back into the tank, but care must be exercised not to get it too warm. It is a good preventive of leaky tubes.

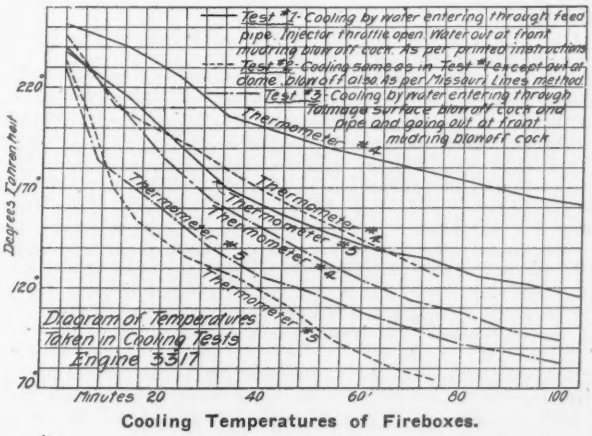
The injection of cold water into the boiler is not only a prolific cause of leaky tubes but also of corrugated and cracked firebox sheets; and this is especially true when the fire is dirty. It is a common opinion that this injury to the sheets in done in the round-house, but it is frequently done on the road. To be sure, the boiler washer can do a great deal of injury in this way, if he is not watched, especially if it is possible to couple the cold water hose to the mudring blow-off cock. When an engine comes in to be washed out, is standing hot in the house, and the boiler washer



Device for Blowing Out Tubes.

couples the hose to the mudring blow-off cock and puts in cold water at about 60 deg., the cold water slides in under the hot water and raises the heated water up as if it were oil. After this has been done, there is a positive line through the boiler, below which the temperature is practically 60 deg., while above it it is 212 deg. The line of separation will not be more than 3 in. wide, and such treatment will be pretty sure to corrugate the side sheets.

In the matter of feeding, there were some advantages attendant with the use of the old-fashioned pump attached to the crosshead, with which, when the engine was standing, it was impossible to put water into the boiler. The old-time enginemen got in such a habit of putting water in, in that way with pumps, that quite a number of them never got out of the habit when they began using injectors, and they were doing exactly what is being asked of the engineman to-day. It is impossible to put water in a boiler for so short a time as 15 seconds, with the ordinary check arrangement, without cooling the bottom tubes a little, according to the amount put in and the condition of the fire, and also according to whether


Test #1- Cooling by water entering through feed pipe. Injector throttle open, water out of front mudring blow off cock. As per printed instructions
Test #2- Cooling same as in Test #1 except out at dome blow off also As per Missouri Lines method
Test #3- Cooling by water entering through Talmage surface blow off cock and pipe and going out at front mudring blow off cock
Thermometer #1
Thermometer #2
Thermometer #3
Thermometer #4
Thermometer #5
Degrees Fahrenheit
Minutes
Diagram of Temperatures Taken in Cooling Tests Engine 3317

Cooling Temperatures of Fireboxes.

the bottom tubes are open. All these things govern and affect it. If the tubes are all open, more can be put in at stations, as the water will be warmed more as it enters. Water goes into a boiler about 238 deg. colder than the water already there, and unless this 238 deg. is added at once the cold feed water will slide down to the bottom and create this bad condition.

Many engineers fool themselves with the idea of filling up with the throttle shut off, thinking that they are saving fuel. But it is impossible to get something for nothing, and if the water is not heated as it goes in, it will have to be done afterwards. It is an interesting thing to note on an engine, where the injector is shut off with the throttle, how the steam stays up and does not drop back when it is again admitted to the cylinders. That is

about what the pump used to do, and is what the enginemen are asked to do with the injectors; that is, put the water in as it was done with the pump, and it can be demonstrated to any engine crew that it will save them leaky tubes. Take a boiler in any ordinarily fair condition, all the tubes open and a reasonable good coal and water; keep a clean fire, and there is no reason why it should not go over any average division without leaky tubes if this simple rule for using the injectors is followed; and it is not as difficult as might be supposed.

In filling a boiler, whenever the hose is attached to the feed pipe the injector throttle should be left open. In this way the waste will go in at the dome by way of the dry pipe. If the injector throttle is not open, the water will go in by way of the boiler check, and it will then drop straight to the bottom as though it had been put in at the mudring.

The introduction of the feed water should be done as high up in the boiler and spread out as much as possible. If the boiler is to be cooled let all of the water be cooled so that the steam gage will indicate what is going on.

Some tests were made on the Chicago & Alton to prove that the water boiled away from the firebox sheets and that the sheets were overheated and burned. These were tests with metal buttons and have already been detailed in the Proceedings of the Master Mechanics' Association. The men who made these tests were disappointed because they expected the buttons to melt. They were, however, a success, in that they demonstrated that the sheets do not overheat when there is any water in the boiler. Crown sheets do not burn out or corrugate or crack so long as there is any water on them.

In the Santa Fe tests, for example, with the gage-cocks extending close in to the fire sheets, they got steam because steam was being formed very rapidly on the side sheet. In order to burn the sheet it would require a constant, unchanging layer of steam there, but as long as there is a changing layer of steam, steam is being made all of the time and heat is being taken very rapidly from the side sheet.

Hot washouts, dirty fires, bad pumping, laying on sidetracks and herding engines with dirty fires, all these things ruin the side sheets. They do not burn out. This statement is corroborated by the results obtained with the fusible plugs used by the government. They melt at about 450 deg., yet they are placed directly over the hottest part of the firebox where the temperature ranges from 2,500 deg. to 3,000 deg. Fahr. They do not burn out, for a sheet will stand 60 deg. or 70 deg. higher temperature than the water and not burn. This is about as high as it ever rises, and that only when the engine is working the hardest. The instant the throttle is closed the fire loses in temperature and the sheet drops down to that of the water, or very close to it. When the throttle is shut off the temperature of the sheet is only slightly above that of the water.

In regard to the effect of cold air on the flue sheets it does not seem that this can be very serious so long as they are backed up by hot water on the other side. So long as the water is hot in the boiler it would be impossible to cool the sheets by blowing cold air upon them.

This matter of inequality of boiler temperatures has an important bearing on the quality of steel that should be used.

In 1894 the American Railway Master Mechanics' Association adopted a tensile strength of 55,000 to 65,000 lbs. for both fireboxes and external shells. At that time there was a minority report asking that the tensile strength of firebox steel be put from 50,000 to 58,000 lbs. Some engines that were built with the milder steel ran five and a half and six years, and those fireboxes were good when the engines were changed to wide fireboxes. They corrugated like a washboard, but there was not a crack in them. The 1854 specification steel was too hard; 55,000 to 65,000 tensile strength is too hard for fireboxes. It will not stand the strains, as the milder steel will. This very hard steel can be used, and by the introduction of some feed water scheme these inequalities may be partially overcome, and it will run much better but not as well as mild steel.

Tubesheet braces should not be made flat. Make them round, and thus avoid damming the water, and locate them so that they will not interfere with the boiler washing. Do not put in a brace too close to the tubes, but leave a good 4-in. space, and not try to tie too tight.

In putting in crown sheets put sling stays in front and rivet over three or four rows. Always slope the crown sheet so that, in case of low water those three or four rows will overheat and let go, and save trouble.

It is of the utmost importance that tubes should be kept clean. A very handy device for this purpose is shown in one of the drawings. It is merely a wash-out plug with a piece of pipe and a stopcock. First run a rod through the tubes to loosen the matter and then blow them out. After they have once been opened it will not be necessary to put a rod or auger into the firebox. The tubes should be opened every trip and kept open. The failure to do this is responsible for many leaky tubes.

It is well not to use the roller in making running repairs. It is quite true that the average boilermaker will say that a good man can use the tool and not do any harm, but the fact remains that more tubes are worn out with the roller in making running repairs than there are in pulling cars. An object lesson tending to sustain this position is in the office of a certain master mechanic. It consists of two strings of tube ends labeled "These made 40,000 miles. Cared for them with the roller;" and "These made 80,000 miles. Cared for them with the expander. The former are thin, and the latter almost as thick as when the tubes were new.

The Armour Car Lines.

Mr. J. Ogden Armour has published in the *Saturday Evening Post* of Philadelphia a long article telling of some of the facts and methods connected with the business of the Armour refrigerator cars and answering some of the accusations which have been made against the company. The first satisfactory refrigerator car was made in 1871 by Mr. Hammond, of Detroit. Several wrecks occurred because the sides of meat, when hung in the cars, were set swinging by the speed of the trains in going around curves. This defect was cured; but not until the circulation of air was provided for, with the ice all put into a box at one end, were completely satisfactory results accomplished. Mr. Armour's father, seeing how the use of refrigerator cars would extend the territory of his meat business, tried to get the railroads to build the necessary cars, but they refused in the most positive manner; and so he had to build the cars himself, which was a decided hardship, for he needed the money in the regular channels of his business. Seeing the success of his cars in the meat business he concluded to go into the fruit carrying trade, and, with Mr. George B. Robbins, now President of the Armour Car Lines, designed and built a thousand fruit cars. Mr. Robbins distrusted their ability to get business enough for the cars, but men were sent around among the fruit growers to awaken them to the advantages which could be gained with the cars, and soon they so aroused the farmers that a second thousand cars were built. Soon the hard times came on, and 2,000 more fruit cars were built, simply to keep the Wells & French Car Works from shutting down. The elder Armour continued to have a lively interest in the fruit industry, aside from the refrigerator business and its profits. The number of fruit refrigerator cars in the Armour lines now is 12,000 (no mention is made of the number used in the meat business). The managers of the Car Lines, with their enterprise and facilities, are the men who have really built up the present great fruit business of North Carolina, Georgia, and other states.

Mr. Armour says that the present agitation against the Armour Car Lines started, not with the growers, but with the commission men, who have been driven out of business by the bringing of the growers and the local dealers into intimate relations with each other by means of the car lines, thus making the middlemen unnecessary. A prominent fruit grower of Georgia says that he is not afraid of the refrigerator car "octopus," but rather is afraid that the "pounding of the refrigerator service by the commission men will cause the octopus to jump the fence and leave us, as in former times, with no octopus but with all our peaches!" There is not one large fruit grower in the country who does not recognize that the private car line is necessary to efficient operation. In former years when fruit growers depended on the railroads and on unreliable supplies of cars, they were at the mercy of the commission merchants, and often when markets were unfavorable had to give away a car of fruit for nothing and pay money in addition to make up the freight charges and the middlemen's commission. The car lines have done away with the evil of glutted markets, as cars are allowed to be diverted while in transit, so that the fruit can always be sent to a good market and in good condition. The Armour private car is not used as a device to secure rebates or discriminations. "It was determined when the prohibitive law against rebates went into effect it was to be obeyed and not evaded; that a policy of indirection and evasion was a poor policy from any standpoint and would not be countenanced by the Armour interests." Mr. Armour then goes on to explain that self interest has impelled the Armour Lines to keep refrigeration rates down to a point that will foster the fruit industry. He quotes figures showing how rates for refrigeration from Georgia have been reduced from the basis which was in effect when five different car lines were competing for the peach business. The rates for refrigeration from California have in 10 years been reduced 27 per cent. to 55 per cent., according to kind, loading point and destination. The fruit growers say, "we want lower rates if we can get them, but above all do not deprive us of the efficient private car line service."

Mr. Armour cites certain serious losses which the business has had to bear. To the strawberry shippers of North Carolina, last summer, $75,000 had to be paid because, owing to extreme congestion on a certain railroad, the refrigerator cars were not on hand at the critical moment. It is necessary to do an extensive business in order to command the necessary capital. At Las Vegas, Nev., the Armour Lines have just put up an ice plant costing $125,-

000. In Georgia, in 1898, great quantities of ice brought from Maine were stored at two places, and the whole of it was lost by melting because there were no peaches that year and no ice needed, the peaches having been killed by a frost. On the other hand, when the crop is more abundant than has been expected the ice supply is sometimes insufficient and large quantities have to be brought from remote places at great cost.

Transatlantic Passenger Business.

The Bureau of Statistics at Ellis Island has published the following statistics of the New York transatlantic passenger business for 1905 and several years previous:

	1905.	1904.	1903.	1902.	1901.
Trips	.....	967	956	922	838
First cabin	104,965	68,704	67,719	.....	.....
Second cabin	107,088	93,685	93,557	.....	.....
Total cabin	212,053	162,389	161,276	139,848	137,852
Steerage	780,012	572,798	642,959	574,276	403,491

Of the cabin passengers in 1905, 107,375 were U. S. citizens and 104,678 were aliens; of the steerage passengers, 25,666 were U. S. citizens and 754,346 were aliens. The White Star Liverpool service and the Hamburg-American Hamburg service each reported 87 sailings during the year, but the North German Lloyd Bremen service heads the list with 89. The following table shows the total trips and passenger traffic of the largest carriers, including all their New York services.

Line.	1905, Trips.	Total cabin.	Steerage.
North German-Lloyd	125	42,817	135,099
Hamburg-American	112	23,109	117,486
White Star	101	27,946	63,516
Cunard	86	21,034	77,493
French	72	11,879	55,927
Anchor	71	11,482	45,751
Red Star	53	11,376	59,432
American	50	12,356	27,106
Holland-America	47	9,923	42,134
Atlantic Transport	47	3,603	29
Fabre	37	181	30,741
Nav. Gen. Italiana.	34	1,594	35,686
La Veloce	29	768	32,479

Railroad Statistics.*

BY A. A. GOODCHILD,

Auditor of Stores and Mechanical Accounts of the Canadian Pacific, formerly Auditor of Statistics.

Statistics have been defined as "the disciplining of a property." They may be said generally to group themselves into two classes. In the first class are those which show results of operation, such as the more general statements found in annual reports; in the second class, such statistics as are devised for the purpose of checking details of operation with a view to improving results. It would be impossible in this paper to discuss all phases of railroad statistics. The field is too large. We must pass over such incidentals to a large railroad as the newsboys, sleeping and dining cars, telegraphs, hotels, dining rooms and steamships, which must all be scrutinized and analyzed in order to satisfy the management that these various branches of the service are being operated satisfactorily. Every station on the line must have its records laid bare and every phase of revenue must be looked after. Do receipts per passenger or per ton of freight keep up? What are the causes for the upward or downward tendency in the ton-mile or passenger-mile rate? What is the average journey per passenger or average haul of merchandise? Are too many cars or trains being run for the amount of business being done? Are the freight cars properly loaded? Is there cross-hauling of empty cars? What is the percentage of empty to loaded cars? These and many other similar questions are the stuff of which statisticians' dreams, and some railroad officials' nightmares, are made; questions which require an answer, not only for the entire road, or for a superintendent's division, but for a superintendent's district or an operating section of that district.

From 60 to 70 per cent. of the entire operating expenses of a railroad are made up from pay rolls, and the importance of closely watching the returns pertaining to these pay rolls, whether the outlay is incurred in the direct production of revenue, or for the purpose of keeping rolling stock and roadbed in proper condition, cannot be overestimated. The large items of pay roll expense are, of course, trainmen, enginemen and station agents. Trainmen and enginemen are well taken care of by comparison with train or engine mileage, and station agents by comparison with the amount of business done at the individual station. The staff necessary for the upkeep of roadbed, buildings and bridges is largely fixed by the management, and the necessary authority or appropriation granted for any work of a special nature as distinct from the general working expense. Roundhouse expenses can conveniently be set off against the number of engines despatched and boilers washed, while the wages paid for maintenance of equipment may for general purposes be compared with the mileage made by cars or locomotives. This latter expense, however, should be considered for a series of months, rather than for any particular month, because cars and locomotives are, as far as possible, repaired when least required for business on the road. Provided a railroad keeps a separate record of its running repairs as distinct from its heavy or shop repairs—a practice in every way desirable—the running repairs can safely be criticized each month, by comparing the outlay with the work performed. In this connection, it would be well if the Master Mechanics at their next annual convention should place on record their views as to what properly constitutes a charge for running repairs for both locomotives and cars. The various roads would then have a fair figure with which to compare themselves with each other, providing, of course, that the basis for arriving at the work performed was uniform. With locomotives it should not be a difficult matter to arrive at a standard basis. If a running repair was understood to include all repairs costing $100 or less for labor, and the 100 per cent. capacity mileage, hereafter referred to, was recognized as the standard unit, a good basis of comparison would at once exist, namely, cost of running, and by deduction, other repairs per 100 per cent. capacity mile. With cars, the problem differs somewhat, but there does not appear to be any insuperable difficulty in handling them on a similar basis, by defining a running repair, and also fixing upon a unit of capacity similar to the 100 per cent. locomotive capacity. Of course, the large number of cars in use complicates matters somewhat, and the suggestion is put forward with a view of getting this question discussed.

Such statistics as are necessary for the purposes above outlined are more or less of a general nature, and their value to the management of a road is much or little, just so far as the detailed analysis of the various comparisons is comprehensive, and no farther. Considerable time of officials and their staffs is frequently lost in replying to criticisms based on such general statistics, due to the immature condition or lack of detail back of them. Instances are not rare where an official has been roughly handled by the management for an apparently poor record, which, upon investigation, and more complete analysis of the situation, he has been completely exonerated. This, after laboring under a stigma extending anywhere from a week to two or three months, almost insensibly tends to harden that official's mind against such general statistics, whereas with proper data available in the first place, the loss of time and annoyance would be avoided.

When one speaks of statistics, the inference is almost natural that train and locomotive performance are specially implied, and while each of the matters already touched upon affords a large field for discussion, the fact is that of all branches of statistics that relating to train and locomotive movement is the most important. The revenue derived from freight traffic usually represents about 70 per cent. of the entire revenue of an American railroad, and while the expenses incidental thereto do not form such a large percentage of the total operating expenses, the proportion is sufficiently large to demand the closest possible analysis. Passenger business is to some extent the creature of circumstances; it is also in part governed by local conditions or considerations, and whether a train pays or not, it sometimes happens that legislative requirements, or the irresistible demands of an enlightened public, compel a company to furnish service not warranted by the financial returns. Competition also sometimes has here an important bearing. Owing to these special conditions statistics relating to passenger train performance have not the same disciplinary value as have those relating to freight traffic; but while these conditions exist there are certain features of passenger train work which cannot be overlooked, such as comparative fuel performance and repairs, and subsequent reference to these branches of statistical information for the freight train service may be applied to that of passenger trains also.

Until within a comparatively recent period it was considered sufficient to know only the distance traveled, as shown by train and locomotive mileage, to confidently criticize a superintendent on his train performance, or a master mechanic on his locomotive performance. Train mileage at first glance looks innocent enough, but has proved misleading. It did not take into account the number of cars in a train, and it ignored the fact that perhaps two or three engines were used to haul the train, one possibly capable of hauling 3,000 tons, while another could handle only 1,200 tons. More than this, statistics based on train mileage failed to furnish any information as to the financial benefits obtained by outlays of capital for the reduction of grades and curves, or to supply any basis for arriving at the saving in cost of transportation effected by the introduction of larger capacity locomotives and cars. Locomotive mileage, as a basis of criticism of locomotive performance, has also signally failed, for similar reasons. With the large investments of capital made during recent years for the purchase of large capacity locomotives and cars, it was but natural that the cost per train or locomotive mile would show considerable increase for fuel and repairs, and it was necessary for a new unit to be introduced which would contain at least the elements of weight and distance, and so we have what is called the "ton-mile" unit. This unit, when

*A paper read at the December meeting of the Canadian Railway Club.

used in conjunction with train or locomotive mileage, has now become the principal basis of analysis in the railroads on this continent, and by its use it becomes possible to arrive at the results obtained from capital investments for the betterment of the line, and to obtain a fair index of operating efficiency on individual sections of a road.

The need for a unit which should combine the features of locomotive capacity, tonnage hauled and distance traveled, became evident as soon as modern large locomotives began to be used, for it was found that the Superintendent who happened to have the larger power on his division could do all the shouting when it came to a question of the size of train, or of tons hauled per train mile; and while it was a simple matter for the statistician to explain that Mr. Jones ought to make a better showing than Mr. Brown, because he had larger engines to work with, it was not considered good statistics to stop there, for there was a possibility that Mr. Brown was really doing better work than Mr. Jones, considering the power at his disposal. Such a unit was designed and put into use on the Canadian Pacific by the writer, nearly three years ago, and was called the 100 per cent. capacity unit. It was decided that the only fair way to deal with the question was to bring all available power to the 100 per cent. basis, which represents 20,000 lbs. pull on drawbar; show the quantity of power each Superintendent had to dispose of, and set off against that quantity the actual work performed. Incidentally it might be said that this unit has proved a valuable one for purposes of comparison in connection with locomotive repairs. Another question still arises, "what percentage does your actual freight ton mileage bear to the potential freight ton mileage?" In other words, if a 150 per cent. engine is capable of hauling 2,000 tons over a given section of the road, 100 miles long, at an average speed of 12 m.p.h., it has a potential freight ton mileage of 17,280,000 ton-miles per month of 30 working days of 24 hours each. We all know that a large portion of an engine's time is used up in the roundhouse or shops for repairs, a considerable portion occupied in taking on fuel and water or in switching and light running, but were the actual percentage of lost potential power figured out the results would probably be startling. Why not compare one superintendent's division with another on this basis for a month every now and then?

Very few roads are as yet taking any cognizance of the matter of "speed" in their statistics. A unit which will incorporate this factor is not only desirable, but imperative, for it carries in itself reconciliation of those diverse interests, the transportation and mechanical departments. Under the present system, an engineer who brings his train in on schedule time, and transforms his power into speed, frequently finds it necessary, in so doing, to make increased demands on the coal pile and "his ton miles per ton of coal" presents a wretched appearance. The superintendent or despatches discovers a "gem" of an engineer, while the master mechanic puts a big black mark against the performance. Per contra, the engineer who converts his power into load is a model driver from the master mechanic's point of view, but the superintendent will probably avail himself of the first opportunity of calling him down hard. The engineer naturally becomes discouraged, and may be pardoned if his language is more forcible than polite with reference to statistics in particular. What is necessary is a unit which will give the engine and the engineer credit for the full amount of power expended, both in attainment of speed and hauling of load, and the opinion that such an unit would be found by taking the minutes occupied in actual running between terminals and dividing the figure into the ton-miles hauled per 100 per cent. of capacity, seems justified. It might be called the "operating unit." Fuel, or pounds of coal used per operating unit, should then furnish statistics, satisfactory at once to the mechanical and transportation departments.

There is one other suggestion with a view of bettering present day methods, and it relates to the direction of traffic. Most roads divide their statistics as between east and westbound or north and southbound. Such division may be useful as denoting the general trend of traffic, but it seems more than probable that a further sub-division setting forth such traffic as is in the direction of the balance of traffic, as distinct from that in the direction of returning power, would be a truer basis from which to criticize locomotive or train performance. With the present system, assuming the balance of tonnage for an entire month is eastbound, it is possible that during a large portion of the month the balance was in the opposite direction, and, as a consequence, eastbound results as shown are misleading, and the good actually attained by careful loading, proper handling of empty cars, and economical fuel performance is largely lost sight of. The tonnage rating system in use on the Canadian Pacific was fully discussed by Mr. Thomas Tait in a paper read before the New York Railway Club in January, 1901 [*Railroad Gazette*, Jan. 18, 1901], and it is not necessary to refer to the matter further than to state, that with the aid of tables or charts, which are available for the use of all transportation officials and employees, it is simply a matter of reference to determine the size of load an engine of any capacity should haul over any section of the entire Canadian Pacific system. The engine capacity can be found by reference to the engine list printed on the cover in which these charts are bound, the figures being arrived at by the generally accepted formula for single expansion locomotives $\frac{C^2 \times S \times P}{D} = T$ in which

C = Diameter of cylinder in inches.
S = Stroke of piston in inches.
P = Mean effective pressure in pounds (85 per cent. boiler pressure).
D = Diameter of driving wheels in inches.
T = Traction power in pounds.

Mr. Tait's paper also explained the method by which the prescribed allowance for the extra resistance due to the proportion of tare being greater than one-third of the actual gross tonnage, and the figure termed "equivalent tonnage," is arrived at. This "equivalent tonnage" is used not only for the proper loading of engines, but as a basis for criticizing the engineer's fuel performance, and with such an equitable figure, the excuse that "my train was all empties, while Bill had all loads and ought to have a better record than I," cannot be advanced.

The importance attaching to an economical fuel performance is manifested in the close attention which is being given to the question by all railroads, and when the vast amount of money involved in the item of "fuel" is borne in mind such interest cannot be wondered at. Many devices have been invented with a view to securing correct returns of fuel consumed, and apart from the methods of

No. 43 RECORD. ☞TOP SHEET.

CANADIAN PACIFIC RY. _____ DIVISION

ENGINEMEN'S TRIP TICKET. COUPON A.

Loco. _____ Train _____ Kind of Train _____

From _____ To _____

Left. Date _____ 190__ Hour _____ M.

Arrived. Date _____ 190__ Hour _____ M.

MILES RUN (See Instructions on inside of cover.)

Train	Light	Doubling	Assisting	Terminal Switching	Switching	Total

TERMINAL SWITCHING AT	FROM	TO	SWITCHING AT	FROM	TO
	M.	M.		M.	M.
CORRECT.				M.	M.
Agent.	M.	M.		M.	M.
CORRECT.				M.	M.
Agent.					

OVERTIME CLAIMED (as per Detention Ticket) Hours _____ Min. _____ Miles _____

DISTRIBUTION OF WORK TRAIN MILEAGE, TO BE FILLED IN AND SIGNED BY THE FOREMAN.

CHARGE TO	MILES

Name of Fireman.

Signature of Engineer.

CORRECT.

Loco. Foreman.

COUPON B.

STOREKEEPER AT _____ Date _____ 190

Oil etc., required for Loco _____ From _____

Kind of Train _____

Engine	Oil	pints	Cotton Waste		pounds
Valve	"	"	Wool	"	"
Car	"	"			
Head Light	"	"			
Signal	"	"			

Received by _____

COAL TICKET. COUPON C.

RECORD NO. _____ Date _____ 190

Station to _____ Loco. No. _____

On Tender from previous Trip	PUT ON TENDER			On tender at end Trip	Quantity used on Trip
Tons.	AT	Tons	Buckets	Tons.	Tons

TONNAGE TAKEN OVER CONTROLLING GRADE (See instructions on inside of cover.) _____ TONS

Signature _____ Hostler at _____

" _____ Engineer.

THIS TICKET MUST BE FORWARDED BY LOCO. FOREMAN AT DESTINATION TO OFFICE OF AUDITOR OF STATISTICS, PER FIRST MAIL TRAIN AFTER EACH TRIP.

Canadian Pacific; Engineman's Trip Ticket.

delivery, which is a problem that railroad managements must themselves be satisfied upon, the question of accounting for deliveries as recorded is one of considerable difficulty. This is done on the Canadian Pacific by an "engineman's trip ticket," form 67E. [See illustration, Fig. 1.] On the lower portion thereof is the fuel coupon "C." This ticket is made in triplicate, the first two sheets having carbon backs. The book of tickets belongs on the engine and must not be taken away by the engineer. When a quantity of coal is put

CANADIAN PACIFIC RAILWAY COMPANY.

SUMMARY STATEMENT_____TRAIN STATISTICS_____190

SHEWING PER CENT. OF INCREASES AND DECREASES OVER CORRESPONDING PERIOD FOR PRECEDING YEAR.

DIVISIONS	DIRECTION	AVERAGE WEIGHT OF TRAIN IN TONS PER MILE: Freight (Tons; Per Cent. of Inc. / Dec.)	AVERAGE WEIGHT OF TRAIN IN TONS PER MILE: Equivalent Gross (Tons; Per Cent. of Inc. / Dec.)	AVERAGE NUMBER OF LOADED CARS PER TRAIN MILE: Freight (Cars; Per Cent. of Inc. / Dec.)	AVERAGE NUMBER OF TONS HAULED PER LOADED CAR (TOTAL) LOAD IN ✱ OF LOAD CAPACITY: Freight (Tons; Per Cent. of Inc. / Dec.)	RATIO OF LOADING TO TRAIN MILEAGE DOUBLING AND ADDITIONS TO TRAIN MILEAGE: (Ratio; Per Cent. of Inc. / Dec.)	RATIO OF WEIGHT OF LOADED CARS TO ACTUAL GROSS WEIGHT OF TRAIN: (Ratio; Per Cent. of Inc. / Dec.)	AVERAGE NUMBER OF LOADED CARS PER TRAIN MILE: (Cars; Per Cent. of Inc. / Dec.)	AVERAGE NUMBER OF LOADED CARS PER TRAIN MILE: (T. ms; Per Cent. of Inc. / Dec.)	RATIO OF "CONTENTS" TO "CAPACITY" OF LOADED CARS: (Ratio; Per Cent. of Inc. / Dec.)	RATIO OF "EMPTY" TO "LOADED" FREIGHT CARS HAULED: (Ratio; Per Cent. of Inc. / Dec.)	RATIO OF "EQUIVALENT" LOAD TO "HAULAGE CAPACITY" OF LOCOMOTIVES (CONSTRUCTION TONNAGE RATING): Rating "A": (Ratio; Per Cent. of Inc. / Dec.)	Authorized Rating: (Ratio; Per Cent. of Inc. / Dec.)	Per Cent. of Reduction Allowed: (Tons; Per Cent. of Inc. / Dec.)	POUNDS OF COAL USED PER 1000 TONS HAULED ONE MILE: Freight: (Pounds; Per Cent. of Inc. / Dec.)	Equivalent Gross: (Pounds; Per Cent. of Inc. / Dec.)	COST IN CENTS TO HAUL 1000 TONS ONE MILE: Freight: (Cost; Per Cent. of Inc. / Dec.)	Equivalent Gross: (Cost; Per Cent. of Inc. / Dec.)	DETENTION HOURS ALLOWED PER 1000 TRAIN MILES: Engine Crews: (Hours; Per Cent. of Inc. / Dec.)	Train Crews: (Hours; Per Cent. of Inc. / Dec.)
ATLANTIC	East.																						
	West.																						
	Total																						
	Eng.																						
PACIFIC	East.																						
	West.																						
	Total																						
TOTAL WESTERN LINES	East.																						
	West.																						
	Total																						
TOTAL ALL LINES	East.																						
	West.																						
	Total																						

ITEMS "AVERAGE WEIGHT OF TRAIN IN TONS PER MILE"

"Freight" represents cars only.

"Equivalent Gross" represents the total weight of trains, contents and cars, plus the prescribed allowance for the same, reduced to the proportion of "tare" being greater than one-third of the total weight.

Note "Coal in cents to haul 1000 Tons One Mile" excludes { Engineman's and Trainmen's pay, Wages, Fuel and other train expenses. }

Canadian Pacific; Summary of Train Statistics; Whole System.

on a tender the fuel man enters the amount on coupon "C" 1, and tears out the duplicate copy, which is forwarded to the fuel department as a voucher. At the end of the trip the engineer estimates the quantity of coal remaining on the tender, and records same in space provided on coupon "C." He then deducts this from the quantity shown to be on hand at the commencement of the trip, thus arriving at the quantity actually used, which he also enters in the space provided. The entire front sheet of this ticket is detached and sent to the statistical office by first train, after having been noted and approved by the locomotive foreman at destination point. Questions sometimes arise as to the correctness of the estimate of quantity left on tender by the engineer making the succeeding trip, against whom such quantity is charged; but the locomotive foreman or hostler has authority to settle such differences of opinion, and disputes are not frequent. When it is stated that, with the use of this ticket, the figures arrived at by the statistical office show a variation of considerably under 1 per cent. with those of the fuel department, it would seem that the question of accounting for fuel issues has been practically solved.

Oil and waste supplies for locomotives are handled in a somewhat similar way. The oil coupon "B," on the same trip ticket, is made out for the necessary supply of oil, and is signed by the man who receives it, and coupon "B" is detached from the second sheet as a stores department voucher. It has been found convenient for the statistical office to accept the statement of issues as compiled by the stores department from these coupons, rather than make up an independent record, but it is at all times a simple matter to check either the stores or fuel departments' charges by referring to the tickets. The question of devising some method of checking the quantity of the different kinds of oil used more effectively and simply than the present method of figuring the miles run per pint, is occupying attention. The Canadian Pacific has in use what is termed an excess oil ticket, and if an engineer requires a quantity of oil in excess of the schedule allowance for the run, he must fill out one of these excess slips and hand it to the locomotive foreman for approval, with a brief statement of the reasons for his requirements. Should the locomotive foreman approve this slip, he makes a requisition on the stores, and sends the approved slip to the divisional master mechanic, also a copy attached to the trip ticket to the statistical office. All of which routine is assumed to act as a check on the demands for "more oil." Mr. Vaughan has recently suggested a statement to take the place of the present record, which will show "quantity used," "quantity as per schedule," "quantity issued on excess slips," and "quantity used less than schedule allowance," also the percentage which the last two items bear to the authorized or schedule allowance. A statement of this sort would not involve as much work in compiling as does the present one showing the "miles run to a pint," and the expensive engines or engineers could readily be detected by simply glancing down the column "percentage of excess." "Miles run to a pint" does not represent anything unless you know how many miles *should* be run to the pint, and this proposed method has the appearance of being very nearly a solution of an old standing difficulty. The unused coupons of the engineer's trip ticket are disposed of as follows: Coupon A2, enginemen's record of mileage, is retained by the engineer, while the oil and fuel coupons B2 and C2 remain in the book, which is turned into the locomotive foreman at the roundhouse to which the engine is attached, at the end of each month, or as soon as all tickets are used, to be retained by him for reference or check, should any questions arise as to the correctness of the performance sheet.

Statistics, to be of value, should be subdivided in such detail as to furnish the results of operation on the smallest sub-division of a railroad. With the Canadian Pacific this sub-division is represented by engine districts, which average from 100 to 120 miles. Comparisons of performance should only be made by one district against itself, unless it is known that the conditions are similar on another district. A study of this matter of comparisons leads one to the conclusion that much valuable time is lost by endeavoring to compare results of trains on one road with another, or even one division with another. Weather conditions, water, grades and fuel, have each a share in producing differences in cost which it is difficult to estimate, but apart from this, there is an even more serious difficulty in making comparisons between two or more railroads. The data used in compiling results are rarely available, and when available are still more rarely harmonious. By comparing one division or district with itself for a corresponding period the difficulties of water and grades are largely eliminated or at all events any change is on record, and fairly reliable conclusions may be drawn from such comparisons. A locomotive performance sheet should be so arranged that all the engines on a district be shown side by side, preferably in order of capacity, and separately for each class of service. This arrangement enables one to correctly appreciate the relative economic value of the different types of engines. It has been a pleasure to the writer to see the practical use to which such an arrangement of records was put up by Mr. Vaughan in his very able paper on superheaters, for without any further need than a reference to the regular month-

ly performance sheets of the Canadian Pacific it was possible to arrive at exact data regarding the performance of superheated locomotives and compare them with other locomotives of similar capacity not equipped with the superheater devices.

The forms used by the Canadian Pacific in compiling and reporting train and locomotive statistics may be briefly described. The conductor's journal, form 125, in conjunction with the engineer's trip ticket, already described, is the basis of the entire records. The necessary information is abstracted on form S.O.1 and worked up on the train and locomotive performance sheets, forms attached. Each engine on each section of the road is given a separate card (form S.O.1) for each class of service in which it is engaged, provision being made on the top of each card for the engine number by a series of "tags" running from 1 to 0—for the last figure of the number. This card is opened from the train despatcher's sheets, the first entry being the date of trip which is taken therefrom. The engineer's trip ticket is then taken and the fuel used on trip entered, while from the conductor's journal is entered all information relating to train and locomotive mileage—car mileage, tonnage, etc., as provided. This method ensures a triplicate check of the entries on the card. At the close of the month or week, or as often as such record is required, the cards are added up and the locomotive performance sheet (form S.O.60) is compiled directly from them. This sheet can be issued within two days after the close of the period for which such information is desired. The generality of locomotive performance sheets show "cost" of fuel and supplies against each engine. Such information is unnecessary. The man operating the engine has nothing whatever to do with the question of "cost," but simply "quantities" used. Form S.O.62, the summary of locomotive performance, properly takes care of all expenses incident to the work performed, including repairs. Apart from the consideration of total cost of repairs compared with the total work performed, all details pertaining to repairs should be dealt with directly by the mechanical department. For the train performance sheet, the various items of performance of all trains operating on each section are summarized, and the totals of these sections represent the work done on a superintendent's division. A summary is then compiled of each general superintendent's division showing the totals of each superintendent's district, and a final summary of the figures of each general superintendent's division gives the grand result for the entire Canadian Pacific system, form S.O.53. [See illustration.] Having the figures of work performed it is a comparatively easy matter to arrive at the cost per ton-mile for hauling. The wages of enginemen and trainmen are compiled in the office of the superintendent for each district for which train records are compiled; likewise the amount of train supplies, while the oil and waste, as before explained, is compiled from the storekeeper's statements of the issues sent in to the statistical office. The fuel is already compiled as to quantity, and all that is needed is the price per ton to arrive at its total value. By dividing the freight and equivalent gross ton mileage into the total cost of each item, we get the resulting average cost per ton-mile for "freight" or "equivalent gross" (form S.O. 52). This average cost furnishes a very fair basis for determining the profitableness or otherwise of any special trains, or any special class of business, on any section or division of the road, when set off against the revenue derived from such business. The results of train operations and car performance summarized on form S.O.53 comprise all information necessary for a complete and intelligent survey of the entire field of train performance, with this qualification that the value of item "per cent. of empty to loaded cars" is impaired owing to the fact that all classes of cars in freight service are comprehended under the general caption "freight cars." It frequently happens that empty flat cars are being hauled eastbound on the same section at the same time as box cars are being hauled westbound, and the statement gives the appearance of cross-hauling or bad railroading, which would be avoided were the movements of the various classes of freight cars kept separate. The great difficulty in the way of working up such a record, as undoubtedly should be done, is one of expense, although it is quite possible, that with the introduction of the Hollerith system of tabulating, that this desirable record may be obtained in an easy and cheap manner.

This question of expense is the serious one to a railroad management. Statistics cost money, and some statistics are dear at any price, but what is worth doing is worth doing well; and well devised statistics should without question become to the railroad company using them a source of profit. The return on the investment cannot be stated in dollars and cents, but it can be stated without peradventure that the company, whose officials are best posted in the details of operation, is the company which supplies its officials with the best possible analysis of work accomplished. It may be further stated that the official who studies such analysis and is guided thereby, must inevitably lead the way on the division or railroad where he is employed.

Finally, there is this to be borne in mind about statistics. We want to know when we have a sufficiency of them. A man may eat a big meal, and enjoy it, but he sometimes suffers for it afterwards. Do not overdo the statistical food—it may react. I believe in getting at the root of a matter, and in putting statistics in as simple a form as possible, and making them as *just* as possible to all concerned. I remember the question coming up in reference to the fuel performance on a certain division, there being a very large increase in consumption per 1,000 ton-miles over the whole *division*. The figures certainly looked very bad, but on analyzing them it was found that on *every district* there was a *decrease*. It was found that traffic conditions had altered to such an extent on two expensive sections as to cause an *increase* in fuel consumption per 1,000 ton miles for the division as a whole. I can assure you this discovery made me careful when criticizing results as shown in statistics and impressed upon me the necessity of getting down to details.

Single-Phase Electric Locomotives and Power Equipment of the St. Clair Tunnel Company.

The single-phase electric locomotive adopted by the St. Clair Tunnel Company for the operation of the St. Clair tunnel, which connects the American and Canadian divisions of the Grand Trunk Railway System, will weigh approximately 62 tons, and will develop a drawbar pull of 25,000 lbs. on a 2 per cent. grade at a speed of 10 miles an hour. It is of the rigid frame type with driving axle boxes held in the same frame that contains the draft gear. It will be mounted on three pairs of driving wheels which will sustain the entire weight, distributed by equalizer bars similar to those used in steam locomotive practice, will have an outside frame supported on semi-elliptical springs, and will be equipped with Westinghouse friction draft gear, M. C. B. automatic couplers, air sanding apparatus, and bumper steps, front and back. The cab will be of sheet steel mounted on a framework of iron which supports both walls and roof.

The principal dimensions will be approximately as follows:

Length over end sills	27 ft. 9 in.
Rigid wheel base	12 " 0 "
Width over all	9 " 6 "
Height from top of rail to top of cab	12 " 6 "
Diameter of driving wheels	62 "

The operating apparatus will be arranged along the sides of the cab, leaving a free passage-way 3 ft. 6 in. wide the entire length. The cab will be lighted and heated by electricity, arrangement being made to screen the instrument lights while the locomotive is running. Westinghouse combination automatic and straight air and American driver brakes will be used. The air supply will be provided by a two-cylinder, motor-driven air compressor having, with a 5-in. stroke and a speed of 190 r.p.m., a capacity of 45 cu. ft. of air per minute. Air reservoirs, signal outfits, whistle, bell with pneumatic ringers, autimatic pump governor, tools, instruments, gages, headlights, push poles and other details complete the auxiliary equipment.

A motor will be geared to each axle, giving each unit an aggregate rated capacity of 750 h.p. The motors are of the Westinghouse single-phase, alternating-current, series-wound, compensating type, whose successful development was first publicly announced in the paper read by Mr. B. G. Lamme before the American Institute of Electrical Engineers in New York, Sept. 26, 1902. They are of the same general character as the motors selected by the New York, New Haven & Hartford for the operation of the line between New Haven and New York. Each motor will weigh complete approximately 14,500 lbs., the armature weighing approximately 5,600 lbs.

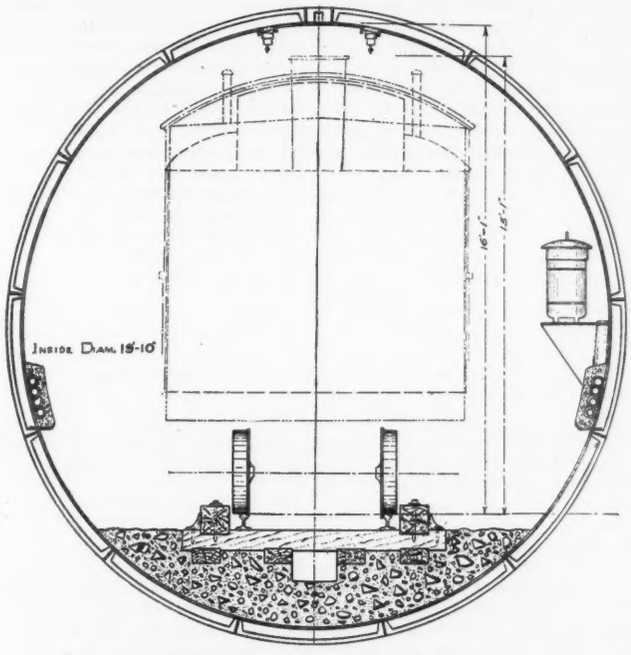
The motor frame consists of a steel cylinder cast in one piece and enclosed at the end by brackets of the same material, which carry the bearings and oil reservoirs. The suspension noses and safety lugs form a part of the main casting. Seats for the axle bearings are cast solid with the frame. All bearings are of phosphor-bronze lined with babbitt and are divided into two parts. They are of exceptionally large dimensions, are arranged for oil waste lubrication, and are provided with large openings on the low pressure side, giving a thorough lubrication of the entire bearing surface. Oil is fed into the reservoirs through openings separate from the waste pockets and therefore reaches the waste from below and is thoroughly filtered before entering the bearing.

The motors are swung between the locomotive frame and the driving axles by a flexible nose suspension from two hangers supported by a truck transom and passing through heavy lugs with helical springs above and below the lug. The motors are held to the axle by means of caps which are split at an angle of 35 deg. with the perpendicular, so that the greater part of the weight is borne by solid projections from the motor frame which extend over the axle rather than by the cap bolts. Large openings above and below provide access to the commutator and brush holders.

Within the cylinder of the motor frame there is built up a core of soft steel punchings, forming a completely laminated field. The punchings are dovetailed into the frame and clamped between end rings of cast steel. The field coils are wound with copper strap insulated between turns and about the coils by mica and finished by taping and dipping, and are impregnated in the best grade of

varnishes, providing a sealed coil which can withstand the most severe internal heat and is practically indestructible under the usual conditions of heavy railroad service.

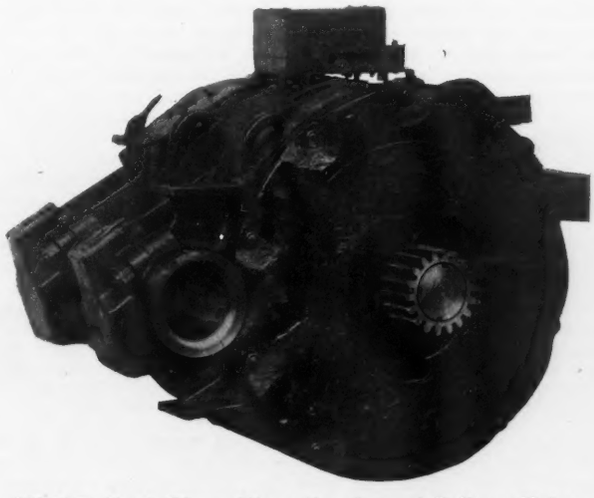
In addition to the main coils the field carries a neutralizing winding which consists of copper bars placed in slots in the pole faces and joined at the ends by connectors of copper strap, so as to form one continuous winding which is connected in series with the main field winding and with the armature circuit. The magnetizing effect of this auxiliary winding is directly opposite to and neutralizes that of the armature winding, thus eliminating the effect of armature reaction and improving commutation and power



Cross-Section of the Sarnia Tunnel.

factor. The main coils can be easily removed without disturbing the auxiliary winding.

The armature cores are formed of slotted soft steel punchings built up upon a spider and keyed in place. The spider is forced upon the shaft with heavy pressure and secured by a steel key. Coils of copper strap are embedded in the slots and joined to form a closed multi-circuit winding which is cross-connected, like the multi-circuit winding of a direct-current generator. The basis of the insulation is mica. A preventive winding is connected between



250-H.P. Single-Phase Alternating Current Railway Motor.

the commutator and the main coils, introducing a preventive action which is effective only when the coil is passing under the brush.

During operation a forced circulation of air supplied by motor-driven blowers enters at the rear, distributes itself thoroughly throughout the motor and escapes through the perforated cover over the commutator. This system of forced ventilation of both motors and auxiliary apparatus forms one of the most interesting innovations in electric railroad construction. It secures a maximum output from a given weight of material, and a high ratio of continuous output to the one-hour motor rating common in railroad practice. It also provides effective ventilation while the locomotive is not in operation as the blower may be driven while the locomotive is standing at the station or the end of the line. Motors ventilated in this manner are enclosed and are thereby protected from internal damage by dirt and water and from mechanical injury. These motors are wound for 240 volts and 25 cycles per second, and have a nominal rating of 250 h.p. each, on the basis of usual electric railroad practice.

The essential elements of the control equipment include the collecting devices, the auto-transformers, the unit switches, the preventive coils, the reverser and the master controllers. A multiple-unit system of control is provided with pneumatically operated switches and circuit breakers, low voltage control circuit, and other characteristics standard in Westinghouse practice. Any unit may be controlled from either end, and two or more units may be coupled together and operated from a single cab and by a single crew. The tractive effort which can be readily applied to a single train is therefore limited only by the number of units available, and the hauling power is limited only by the mechanical strength of the coupling between locomotive and cars. A control circuit is carried from one unit to the next by means of connecting sockets and jumpers in the usual manner.

Speed control of the driving motors is secured by variation of the voltage at the motors obtained by means of taps taken from the winding of the auto-transformer which receives current from the trolley at 3,000 volts and reduces it to 240 volts or lower, according to the tap employed. These taps are connected to unit switches from which current is led through the preventive coils to the motors. Four unit switches serve to reverse the field of each motor.

The unit switches are of standard Westinghouse design, and are, in effect, pneumatically operated circuit breakers of great power and reliability. The mechanism is such that a rolling and sliding contact is obtained when the switch closes and opens. The arc is broken at the tips, leaving the contact surfaces smooth and unscarred. Each unit has a magnetic blow-out coil with laminated core. The switch cylinders are controlled by magnetically operated valves, current for which is obtained from a 50-volt tap from the auto-transformer. The sequence of operation is governed by the master controller in conjunction with a system of interlocks which prevents short circuit of the steps between taps from the auto-transformer or improper operation of the controlling mechanism. At any running point four controlling switches are closed. Through the preventive coils approximately the same amount of current is drawn from each of these switches and the leads to which they are connected. To change to a higher voltage on the motors, the master controller is moved to the next notch, opening the last switch of the group that is closed and closing the switch next higher, with the result that the motor voltage is shifted up one step. By this arrangement the voltage at the motor will be completely under control of the locomotive driver and may be varied up and down at will without opening more than one-quarter of the load current. Small switches in the circuits to the magnets of the reversing switches will enable any motor or combination of motors to be cut out without disturbing the others.

Every one of the 17 controlling connections provides an efficient

Motor and Gear Case Mounted on Locomotive Axle.

running point. This number is ample to prevent any slipping of the driving wheels due to increase of current from one notch to another. Whether empty or heavily loaded, operated in single or multiple units, torque and drawbar pull may be gradually applied and the locomotive started without jar.

Each locomotive unit will be equipped with a pneumatically operated pantagraph trolley to collect current from the overhead lines outside the tunnel and throughout the yards. The propor-

tions of the pantagraph will be such that, when extended, it will make contact with the trolley wire 22 ft. above the rail, and, when closed down, the contact shoe will not extend more than 18 in. above the roof of the locomotive. The pantagraph will have a broad base and will be constructed of light and stiff material.

A No. 0000 grooved overhead trolley wire will be suspended from a single ⅝-in. high strength, double galvanized, steel strand, messenger cable by hangers of varying length in such a manner that the trolley wire will be approximately horizontal. The messenger cable will be swung from structural iron bridges located throughout the yards and of suitable length to span the proper number of tracks. There will also be a small section of track equipped with a trolley line swung by catenary suspension from bracket arms which are supported on lattice-work poles.

For the operation of the electric locomotives a complete power plant will be installed, including two 1,250-k.w., 3,300-volt, 3-phase, 25-cycle, rotating field, Westinghouse steam turbine units running at 1,500 r.p.m. with the necessary complement of switchboards, exciters, lightning protective apparatus, etc. This station will also supply current to light the buildings, yards and tunnel, to operate motor-driven centrifugal and triplex pumps which drain the tunnel and approaches and operate the sewage systems, to run motors in the roundhouses and for other purposes.

The new equipment will be used on that portion of the Grand Trunk Railway System which connects the divisions terminating at Port Huron, Mich., and Sarnia, Ont., on opposite sides of the St. Clair river. The tunnel proper is 6,032 ft. long and the line to be electrically operated is 19,348 ft. from terminal to terminal.

A pair of the new units will be capable of hauling a 1,000-ton train through the tunnel without division. Mechanical considerations limit the advisable weight of train in the tunnel to these figures. Heaver trains can be divided or sent through together with locomotives in front and behind. The service requires that each unit shall take a train of 500 tons through the tunnel block from summit to summit in 15 minutes under the following conditions: It will be coupled to the train in a level track at a point 1,200 ft. from the summit and must accelerate it up to a speed of 12 miles an hour in two minutes, at the end of which time it will have reached the summit of the grade leading down into the tunnel. It will then run down a grade of 2 per cent. to the level track in the tunnel at a speed not exceeding 25 miles an hour, continue on the practically level stretch under the river, and then draw the train up a 2 per cent. grade at the rate of 10 miles an hour to the level track beyond the tunnel approach on the other side. It must then gradually accelerate the train until a speed of 18 miles an hour is reached. Each unit must be capable of exerting a tractive effort of 25,000 lbs. for a period of five minutes in addition to the energy required to accelerate the train at the starting point and to run with it into the terminal yard, from which point it must immediately run back to a position 1,200 ft. from the summit, couple to another train and be ready to start through the tunnel in the opposite direction. It must therefore make a run of the character described every 30 minutes. Six of these locomotives are to be furnished by the Westinghouse Company. It is expected that the electric equipment will greatly relieve the traffic congestion now existing and due in a large measure to the necessity of dividing trains at the terminal points, and to greatly simplify the operation of the road. Its opening will mark the progress of electrical methods in the railroad field under conditions which seem peculiarly fitted to demonstrate its practical advantages in heavy service.

The work of installation will be conducted under the supervision of Mr. Bion J. Arnold, of Chicago, Consulting Engineer for the Tunnel Company, by whom the plans and specifications were prepared. Mr. Arnold was one of the first engineers in America to advocate the employment of the single-phase, alternating-current system in railway service. He is also a Past President of the American Institute of Electrical Engineers, a member of the Commission in charge of the electrification of the New York Central Railroad system in New York, and has been closely identified with many electrical developments of great importance.

Steel Rail Outlook.

The *Wall Street Journal* publishes the following summary of the probable extent of the steel rail business in 1906. The rail mills of the country begin the year with close to 2,500,000 tons of business on their books, and the prospects are that the total production of the country in 1906 will be in the neighborhood of 3,300,000 tons, or about 300,000 tons in excess of the high record year of 1903, and 600,000 tons in excess of 1905. If the output is as large as expected the tonnage will represent a gross business of $92,000,000. There has been no extraordinary increase in steel rail production over the last seven years. As a matter of fact rail production has not kept up in this respect with many other classes of finished steel. In 1901 the rail production of the country was 2,874,639 tons, and during the depression of 1904, 2,284,000 tons were turned out. The production of steel rails over the last seven years, together with the price per ton and gross value, follows:

	Tons.	Price per ton.	Gross value.
1906	*3,300,000	$28.00	*$92,400,000
1905	*2,700,000	28.00	*75,600,000
1904	2,284,711	28.00	63,971,908
1903	2,942,477	28.00	83,789,356
1902	2,947,933	27.33	82,542,124
1901	2,874,639	27.33	78,463,788
1900	2,385,682	22.29	76,933,671

*Estimated.

The feeling in iron and steel circles is that, regardless of crop conditions, the rail mills will be kept active all through the current year. It is pointed out that the railroads will be forced to increase their equipment materially in order to conveniently handle the vast and ever increasing amount of freight consigned to them. There are now 1,700,000 freight cars in use, but it is claimed that it would require many hundreds of thousands more to satisfactorily handle the freight. Nearly 1,000,000 freight cars have been manufactured in the last seven years, or at the rate of 130,700 a year. The output of rails generally moves in sympathy with the output of cars. The United States Steel Corporation now has a steel rail capacity of at least 2,300,000 tons, but if the Youngstown mill continues to work on sheet and tin bars in preference to rails the corporation's production this year will not be as heavy as it otherwise would be. The rail production of the United States Steel Corporation over the last four years was as follows:

	Tons.		Tons.
1905	*1,700,000	1903	1,934,000
1904	1,240,000	1902	1,920,786

*Estimated.

The exports of steel rails for the eleven months ended Nov. 30, 1905, were as follows:

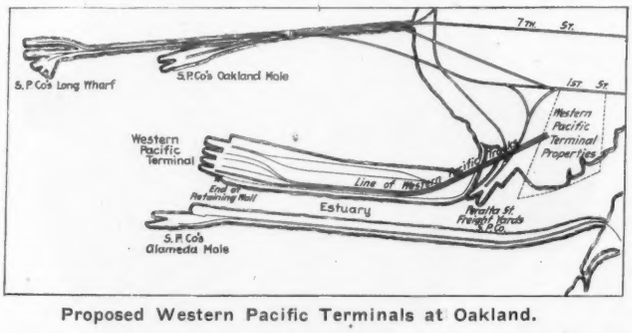
11 mos.	Tons.	Value.	11 mos.	Tons.	Value.
1905	273,306	$6,677,737	1904	395,849	$10,182,402

As long as domestic consumption continues as large as at present there is no likelihood of rail exports exceeding last year's shipments to any great extent.

Western Pacific Terminals.

The Western Pacific and Southern Pacific Companies have each filed plans at the local office of the United States Engineering Corps for proposed terminals at Oakland, Cal. Each asks permission to fill in ground on the north side of the retaining wall built by the government to define the channel known as the Oakland Estuary, lay tracks on such ground and build depots and docks at the western end. The accompanying sketch shows the Western Pacific's plan; that of the other road differs only in detail.

The Southern Pacific, whose yards are northeast of the property designated Western Pacific Terminal, now has tracks extending out to deep water on two moles built some time ago. It needs more terminal facilities, but the present building of more yards and docks is for the immediate purpose of blocking the Western Pacific scheme. At this time it is impossible to say whether or not the older company will succeed in thus shutting out the new company. Both roads have employed the usual methods: injunctions and the sudden occupation of disputed territory. The Western Pacific has so far been the more successful in the use and evasion of court orders. First, it stopped the Southern Pacific from



Proposed Western Pacific Terminals at Oakland.

building a trestle from the Peralta street freight yard, of the last named road, to the end of the retaining wall. Then the Southern Pacific obtained injunctions from the city authorities restraining a dredging company, which was deepening the channel of the estuary, from dumping sand on the north side of the retaining wall, but as the dredging was being done under a federal government contract the order was disregarded and another injunction, aimed to prevent the Western Pacific from laying track on the made ground thus formed, was also unsuccessful since the ground concerned was federal property.

As to actual construction the present status is as follows: On January 8 the Western Pacific laid rails west as far as the lighthouse on the strip of ground above referred to as adjoining the

north side of the retaining wall. The same company had been building a bulkhead parallel to the retaining wall and some distance to the north of it, and was enjoined against continuing to do so. They then laid ties across the tops of the piles they had driven and spiked rails on them, thereby converting the structure into a trestle, a work which the injunction did not cover but which attained, as well as a bulkhead could have done, their object, which was to enclose the contested strip of ground. On January 9 the Southern Pacific hastily laid a half mile of track from the ferry slip south of its Peralta street yards eastward toward the Western Pacific terminal property, and then drove piles in the marshy ground just east of that property for the foundations of shops. Work on these shops is being rushed, the purpose being to prevent the granting to the Western Pacific of a right-of-way from First street southeast across the freight yards to the retaining wall, the latter road having asked the city council for a 47 year franchise for this route.

Meantime, the Western Pacific has a launch equipped with a searchlight and gatling gun patroling the waters around the retaining wall, and has posted armed guards to protect the line of track already laid, while the Southern Pacific has enlisted the service of the state police to watch the men of the rival road and, if possible, prevent any more surprises.

Shipping Subsidies.*

BY ROYAL MEEKER.

Three "reasons" for subsidy are usually given by those who advocate this method of building up our merchant marine—first, the greater cost of construction in American yards; second, the greater cost of maintenance and operation under the American flag; and third, the bounties given by other nations. The greatest diversity of opinion prevails as to the amount of difference in cost of construction. The Merchant Marine Commission, appointed by Congress in 1903, gathered much testimony on this subject. The cost of construction in American yards was estimated by different witnesses to be anywhere from 20 to 100 per cent. greater than in English yards. Nearly all agreed, however, that it costs more to build vessels in America than in Europe. Most of the witnesses favored subsidies as the proper means of neutralizing this disadvantage in initial cost. In regard to operating expenses there is even greater diversity of opinion. The testimony taken by the Merchant Marine Commission is full of contradictory statements regarding wages of seamen on board American vessels as compared with wages on foreign vessels. Seamen and representatives of seamen's unions asserted that wages were not a matter of nationality at all, but were determined wholly by the port where the crew was engaged. Some owners declared that wages of ordinary seamen were determined by the port, but that salaries of officers were governed by the nationality of the ship. Most ship-owners and all ship-builders asserted with great positiveness that wages were wholly a matter of nationality, and that the port had nothing whatever to do with them. It was asserted repeatedly that Norwegian sailors would work on board a Norwegian ship for less than half the wages they would demand on an American vessel. At the same time it was asserted that sailors of all nationalities preferred American vessels to any others because of the better food and arrangements and the larger and more comfortable quarters assigned to the crew. These contradictory statements cannot be reconciled. They were presented as "facts." It is doubtless true in many cases that laborers, by reason of their own ignorance and shortsightedness, receive no greater pay for especialy hard or dangerous labor than others receive for safe and pleasant labor of the same grade; but it seems hardly possible that sailors are so perversely ignorant that they demand wages in inverse proportion to the danger and irksomeness of their tasks.

The calm assurance with which the advocates of subsidy assume that bonuses to shipping will immediately result in rapid expansion of the merchant navy is rather irritating. The basis of this assumption consists of citations of "statistics" relating to the effects of English, German and other subsidies. The statistics do indeed show rapid growth of English and German commerce and shipping. Since English and German shipping is prosperous and these countries pay subsidies, it is argued that subsidies cause shipping to increase. Such a use of statistics brings contempt upon the statistical method.

Discussion of British subsidies can refer only to postal subventions, since Great Britain never has given general bounties on construction or navigation of ships. *A priori*, it seems unlikely that postal subventions can build up a merchant marine. They help only such vessels as are suitable for mail service. These constitute but a very small proportion of the total merchant tonnage (in the case of Great Britain, about 2 per cent.), and they carry even a less percentage of the entire commerce.

If the mail payments are sufficient only to remunerate the contracting company for the necessary cost of the service it performs, it is reasonable to suppose that the contract will act merely to concentrate the ocean-mail business into the hands of the contracting company. The building and sailing of ships will not be in the least encouraged or accelerated. The contracting line will grow at the expense of other shipping.

If the subventions are larger than the necessary cost of the service, two results are possible. Either the payments serve to remunerate inefficiency for its inability to make profits, or the bonus above the cost of service bestows upon the contracting line a monopoly advantage, giving it power to cut freight and passenger rates under the competitive point. This condition might encourage the contracting line to expand until it had absorbed a large part of the business of its rivals. The motive for this policy would be the hope of enhanced profits, and the only way to secure such profits is to drive out rivals and then raise freight rates above the competitive price. The effects of such a policy are first to stimulate and then to discourage the growth of shipping.

Whether the British imperial mail contracts can or cannot be justified on other grounds, it cannot be shown that they have helped in the least to add permanently to the tonnage of British shipping.

The mail subsidy policy began in Germany in 1885. The mileage rates paid are lower than those paid by Great Britain, though on the basis of the weight of mails carried they are much higher. On the whole, the mail subventions paid by Germany seem no more than a fair compensation for the services rendered, taking account of the speed requirements, the regular times of sailing, and the free carriage of officials and official dispatches. In addition to these subsidies the German government grants free importation of all materials of construction and gives preferential railroad rates on such materials. Besides, the state gives special assistance to certain lines in the way of special through freight rates, which give the railroad an unduly small proportion of the combined rates on exports from Germany. Neither the amount of these indirect bounties nor their effect on export can be accurately estimated. Commerce and shipping have expanded, and it is reasonable to suppose that the preferential rates had some influence in this direction. If larger exports and greater tonnage are the only considerations, then the German system of preferential rates would seem to be a more efficacious method than mail subventions. But if state expenditure should bear any just relation to value received, then the expediency of these state favors may well be questioned. To ascribe the rapid progress of German shipping to bounties, direct or indirect, is absurd. In the first place, this rapid expansion began in 1881, four years before mail subventions were granted and long before preferential railroad rates were inaugurated. Secondly, Germany does not pay large subsidies. The total amount of the mail subventions is but little greater than the amounts which the United States is now paying on account of contract ocean-mail service for much shorter routes and less onerous service. Computed on either a mileage or weight basis, the German rates are much lower. Thirdly, no possible connection between the state aid and the growth of the merchant marine can be established. On the other hand, other economic causes are sufficient to explain Germany's maritime growth. The emigrant movement to the United States built up the North German Lloyd and the Hamburg-American lines. The industrial revolution in Germany since 1880 accounts for the expansion both in commerce and in shipping. The effects of the bounties, both direct and indirect, are insignificant compared to the effects of these economic forces.

Of the countries giving direct bounties on construction and navigation, France offers the most instructive study. * * * This shows a most unhealthy condition—a marine increasing in size and diminishing in utility. While the bounties appear to have brought about an increase in tonnage, they have at the same time sapped the remaining vitality of French maritime enterprise and left it a giant infant which becomes more dependent the larger it grows. The experience of France shows luminously the vast difference between a valuable merchant marine and an expensive one. The French postal subventions are even larger in amount and are therefore probably more influential than are the general subsidies. The cost of constructing steamers is estimated to be 25 to 50 per cent. greater in France than in England. How much of this greater cost is due to natural economic conditions and how much is due to the bounties cannot be determined. French ship-owners complain that builders are united in a trust and charge enough for construction to absorb the whole of the bounty to navigation. As foreign-built vessels are not entitled either to navigation bounties or postal subsidies, the builders have the owners on the hip. Under the circumstances it is absurd to speak of a bounty to equalize first costs. Costs of construction increase with the bounty, so that if the government chose to double its mail subsidies the "costs of service" would absorb the whole amount. First costs of steamers, docks, etc., would be doubled, and so on down the line in beautiful procession. The service will cost as much as the government is willing and able to pay.

The United States has experimented from time to time with

*Abstract of an article in the Political Science Quarterly for December, 1905.

mail subventions, and the results have not been very happy. From 1847 to 1858 the government paid nearly $15,000,000 in mail subsidies to six different steamship lines. The subsidies failed to give any permanent impetus to steam navigation. From 1865 to 1875 Brazil and the United States paid jointly $250,000 a year for a mail line between New York and Rio Janeiro. When the subsidy ceased the line suspended. The subsidy created and supported the line, but the mere existence of this line had no discernible effect either on commerce or shipping. In 1867 the Pacific Mail commenced a monthly service between San Francisco and the Orient on a subsidy of $500,000 per annum. Five years later the company offered to double the service for another $500,000. After great difficulty a bill authorizing the increased service passed Congress. Later it was proven that the company had spent about a million dollars in more or less direct bribery to secure the passage of the bill. Because of the improper methods used to secure the necessary legislation, the later contract was annulled. During the period of subsidy, imports from China and Japan increased somewhat, while exports actually decreased. The subsidized steamship line was no more responsible for the one than for the other. Trade with South America and Asia remained practically stationary because we had nothing that the inhabitants of those two continents wanted. A subsidy large enough to enable goods to be given away could scarcely have increased exports much. No development of shipping resulted from this burst of subsidy. In a speech before the House of Representatives in 1879 on the occasion of a new subsidy proposition for a line to Brazil, Mr. J. G. Cannon said:

> Beginning with the year 1847, down to the present time, we have paid out of the Treasury over $21,000,000 for the purpose of establishing steamship lines. Seven million dollars would buy all the steamship lines engaged in commerce that sail under the American flag on every ocean in the world, and more than that, the subsidizing of these steamship lines, from the Collins line in 1850 up to the present time, has bankrupted every prominent man that favored it.

The disgraceful experience with the Pacific Mail discouraged further subsidy schemes until 1891, when the present ocean mail act was passed. It establishes four classes of steamships to receive respectively $4, $2, $1 and $0.66⅔ per mile traversed as compensation for carrying the mails. At its passage it was confidently predicted that ocean transportation would as a consequence be revolutionized and American shipping would soon cover every sea. Six mail lines have been established under the law, demanding a yearly expenditure of nearly $1,500,000, but no revolutionary developments in American shipping have yet resulted. The impossibility of building up the merchant marine by subsidies, reasonable or exorbitant, for carrying the mails has already been pointed out.

There is a widely prevalent belief that a country must possess a large merchant navy in order to be an independent and self-respecting nation. It is further believed that the nation which must make use of the merchant shipping of foreign countries is economically dependent upon those countries. So far as economy is concerned, there is no reason why we should object to having our freights carried by Englishmen, Norwegians, Italians and Germans. So long as these people can carry them cheaper than we can ourselves, there is nothing but gain for us in the transaction. If we were willing to forego the patriotic joy of manning American ships with native Americans, it would be possible to obtain a merchant marine and to run it under the American flag without any bounties. It would be necessary only to allow our shipowners to buy their ships in the cheapest market and man them on the same terms. If our navigation laws allowed free ships and freedom in the navigation of ships, there would be nothing to hinder American shipping in the foreign trade from expanding rapidly. But those most agitated by our maritime decadence do not want the merchant marine rehabilitated in this most rational manner. A merchant marine, they say, can have no permanence or value unless built at home.

If our marine is to be built at home, the difference in cost of construction, if any, must be made up by a subsidy in some form. Shipbuilders place the costs in American yards anywhere from 20 to 100 per cent. higher than the costs in England. When guesses (they can scarcely be called estimates) vary so widely, it is idle to talk of a subsidy to make up the difference in first costs. It probably does cost more to build ships in the United States than in Great Britain. It would be odd were it not so. The ship-building industry in Great Britain is highly organized on an extensive scale. Where the American builder constructs one ocean-going steamer, the British builder constructs scores. Fixed charges form a much larger proportion of costs in American yards. Duplicate parts are used extensively in the construction of British tramp steamers, cutting down costs greatly. Were the industry organized on a larger scale in the United States, there is every reason for supposing that ships could be built as cheaply here as anywhere else. It is well known that in the production of all other kinds of steel structures our manufacturers can compete with the world.

To-day the world is confronted by an over-supply of ships. Ever since the end of the Boer war freights have been very low. This fact gave Mr. Morgan his inspiration to organize all the steamship lines of the North Atlantic into a big trust. Shipyards are working short time and turning out work at prices very little above cost. There is no great demand for steamships, and a further decrease in prices does not seem likely to create such a demand. Better organization in the ocean transportation business is much more needed than either more or better ships. In fact, a reduction in the number of ships would give a more economical service. One effect of an American subsidy would be to increase an already redundant shipping. Would this bring down freights and so lead to expansion of commerce with all its attendant blessings? Scarcely, for every idle ship is a pauper, depending for support upon active shipping. Furthermore, every unused compartment in every ship in service represents idle capital, which earns nothing but which demands dividends. The proposed subsidies would probably increase the costs of ocean transportation by increasing the amount of idle tonnage. Of course subsidies might be made large enough to pay part of the costs of transportation, however high. The government might even pay all the ocean freights. This would certainly tend to the expansion of commerce. Such a policy would differ from other subsidy schemes only in the degree of wastefulness and imbecility.

There is then no good economic reason for granting subsidies to the merchant marine either for construction or navigation. The political arguments are two in number—first, the need of national self-sufficiency, and second, the need of a merchant navy to serve as an auxiliary naval force and to furnish transports and seamen for the war navy. As to the first count, it is impossible for any nation to be entirely independent of other peoples. To hire foreign ships is no more an indication of inferiority or dependence than to buy foreign fish or flannels. Secondly, as to the military value of a merchant fleet, it is obvious that it is a source of danger and not a protection in time of war. Witness our own Civil War, when a few Confederate cruisers swept half our great merchant marine off the seas in spite of our powerful war navy. The more shipping a nation possesses the more vulnerable it is to attack. It is much cheaper and better for the government to build cruisers that can cruise than to subsidize private corporations. The war vessel has become so highly specialized that no mail steamer can be successfully converted into an efficient cruiser. The fastest are too slow to run away from a real cruiser built for speed, and the strongest are too weak to fight. As regards the ordinary merchantmen which make up nearly the entire commercial navy, canal boats could as readily be converted into engines of war as these lumbering ocean-drays. If we had no merchant vessels, the argument for a merchant navy to train up seamen for the war navy would have great force. But the United States ranks next to Great Britain in the tonnage of her merchant fleet, and close after Germany (*i.e.*, third) in the tonnage of her ocean-going vessels engaged in foreign trade. There is no pressing need of hiring vessels to train up seamen.

If we want to acquire a merchant navy in any case, whether we need it or not, we must pay the price. The childish faith in subsidies manifested by some of our oldest and therefore, according to a popular superstition, wisest politicians is depressing. The report upon the last bill introduced into and finally passed by the Senate (1902) reads in part as follows:

> The purpose of this bill and its reasonably certain results will be within ten years to establish the maritime supremacy of the United States in the trade on the Pacific with Asia and the Philippines and on the Atlantic in the trade of the Gulf of Mexico and the Caribbean Sea; to establish on a secure basis the trade between the United States and the republics of South America, and to give the United States a respectable representation in the trade of the North Atlantic. Incidentally it will give to the United States an auxiliary navy second only to Great Britain's; an ocean mail service superior to that of Great Britain, France or Germany in all respects—except for a few years more possibly, the service between New York and England and the North Sea ports. It will so extend shipbuilding as to transfer in time, certainly from Germany, and possibly from Great Britain, to the United States, the center of that industry, as the centers of other industries recently have been transferred. Finally, it will give to the United States a measure of maritime independence corresponding to our industrial and agricultural independence. This object and these results are perfectly well understood abroad, and afford the reason why the measure is regarded with undisguised apprehension and hostility by the shipping interests of Europe.

All these grand results are to be accomplished by the yearly expenditure of a paltry $4,700,000 in mail subventions and a million in general subsidies. The total is but little more than the mail subsidies paid by France, and not a million dollars greater than the subventions paid by Great Britain. Yet the American people are seriously asked to believe that the costs of construction and of navigation are 25 to 100 per cent. greater under the American flag than under the British flag! Surely to overcome such great differences an appallingly large subsidy would be necessary. Briefly, there appears to be no way of getting something for nothing, even by the occult means of government subsidies. If we dance we must pay the piper. Possibly we may be allowed to pay the piper though we do not dance. For were costs of construction, etc., in the United States no greater than in Great Britain, they could be made to appear so for the sake of a bounty, and when once a bounty is given the costs can be made to conform to its size.

GENERAL NEWS SECTION

NOTES.

George L. Rives, counsel to the New York Rapid Transit Commission, says that a bill permitting the board to let separate contracts for the construction and operation of future subways has been drafted and sent to Albany.

On all the roads of Mexico where Pullman cars are in use, the rates for berths and seats in those cars are to be advanced on February 1 about 50 per cent. The change in the value of silver is given as the principal reason for this action.

The fast Havana express of the Mobile & Ohio, which is to run once a week between St. Louis and Mobile, made its first trip on January 5 and 6. This train leaves St. Louis at 9:45 p. m. and reaches Mobile at 3 p. m. the next day. The time through to Havana is 53 hours.

The publishers of *McClure's Magazine* have been sued for $100,000 in each of two suits for libel by the Union Refrigerator Transit Company, of Wisconsin. The plaintiff claims to have been injured by the publication of articles in the magazine concerning illegal freight rates.

The Erie Railroad is experimenting with a fan at one of the shafts of the Bergen tunnel, Jersey City, to exhaust the smoke and gases from the tunnel. A large fan made by the Buffalo Forge Co. has been set up at the top of the shaft, with a second-hand locomotive boiler to furnish power.

The committee of western traffic men who recently made a pilgrimage to Washington to inform the Government that they intended to obey the laws, has adopted a permanent organization. Mr. Stubbs is Chairman and Mr. W. H. Hosmer, of the Western Trunk Line Committee, is Secretary.

A press despatch from Washington says that a committee representing the eastern Trunk Lines has called upon the Interstate Commerce Commission and given to the commissioners the same assurances concerning their intentions to obey the law that were given by the western roads a fortnight since.

According to the Wilmington (Del.) *News* the freight train men of the city, presumably those running on the Philadelphia, Baltimore & Washington, are now so busy and in such constant demand that when a trainman goes to a theatre he gives the box office the number of his seat, just as is done by physicians, so that when he is wanted he can be quickly reached. The theatre men find on their list more railroad men than physicians.

At Utica, N. Y., January 10, the Grand Jury in the United States Court indicted the New York Central and the Delaware & Hudson roads for giving to the General Electric Company, Schenectady, rebates of 20 cents a ton on freight. It is said that this rebate is an allowance for terminal expenses. The General Electric Company has tracks and shipping facilities of its own, and delivers freight to the railroads in carloads, ready to be sent forward.

By new tariffs which went into effect on the first of January eastbound freight rates from St. Louis are considerably modified, so as to absorb a part of the bridge arbitrary on most commodities; and, according to announcements made in St. Louis, the westbound rates to St. Louis over the same roads will be reduced in a similar manner on February 1. Including a reduction in the bridge charge on soft coal from Illinois, the business of St. Louis, it is said, will be benefited several hundred thousand dollars yearly.

At Altoona, Pa., a new order has been issued forbidding employees in the railroad shops to cross the tracks or to ride on engines or freight cars while going to and from work; and not only has the order been emphasized but watchmen have been stationed to detect and report violations of it. It appears that among the thousands of men employed in the Altoona shops there are a great many who have made free use of the extensive freight yards as thoroughfares, and that many serious accidents have occurred.

The eight "auditors" now collecting fares on trains of the Great Northern Railway are so satisfactory that, it is said, about 50 more men will be put on to trains to perform this service. According to the Minneapolis *Tribune* the conductors will now be able to give their undivided attention to the handling of their trains; and, if the railroad company's circular is correctly quoted, the "auditors" will also be expected to give undivided attention to the work assigned to them, for they will "under no condition be permitted to occupy seats with lady passengers." The auditors are expected to assist the other train employees in making passengers comfortable.

Passes.

According to a newspaper item, the number of season passes now in force on the Long Island Railroad is 3,800 less than it was on January 1. By the same authority it is stated that the travel on the 3,800 passes now cut off has amounted to $6,000 a month. A press dispatch from Altoona says that the abolition of passes on the Pennsylvania Railroad has been followed by the withdrawal of the half-rate privilege on "charity tickets." It appears that the half-rate tickets sold to town and city officers for the benefit of paupers, or other indigent persons, have been so manipulated as to benefit persons who were able to pay full rates. At Philadelphia a meting of Pennsylvania Railroad employees is said to have indulged in protracted grumbling because the superintendent has notified them that henceforth they can have only four or five passes a year, and that on the West Jersey & Seashore they (P. R. R. men) can have none.

Lively Traffic Doings in the Effete East.

The cordial relations which have existed for more than twenty years between the New York, New Haven & Hartford Railroad, which controls the Sound steamboat lines from New York City to New England points, and the Metropolitan Line, which operates freight boats between New York and Boston, outside of Cape Cod, will shortly be broken and a bitter rate war for the control of New England freights is likely to be precipitated. The disruption has resulted, it is said, from the acquisition by the Morse interests, which now control the Metropolitan Line, of the Eastern Steamship Company's lines from Boston to Maine and New Brunswick ports, thus threatening a monopoly of freights east of Boston. The New Haven road also resents the entrance of the outside line into the passenger business, the latter having given an order last fall to the New York Shipbuilding Company, of Camden, for two fast turbine passenger steamers to go on the route early next year.

The New Haven interests have now placed an order with the Cramps for three large freight steamers, to be delivered next January, and will start another outside route between New York and Boston to compete with the all-water route of the Metropolitan Line, which has enjoyed a 10 per cent. differential over the Sound lines for Boston and points east of there.

The first gun in the fight will be fired next Monday when R. T. Haskins, who has been connected with the Metropolitan Line for 36 years, latterly as traffic manager, assumes charge of the freight traffic of the Sound lines, and who will also be made general freight agent of the new outside line. Harry H. Benedict, outside freight solicitor for the Metropolitan Line, has also resigned to accept a position as Mr. Haskins' assistant.

It is understood that a subsidiary company will be formed to operate the New Haven's outside line. The water lines at present in the New England and Maine fields are the Metropolitan Line, Fall River Line, Providence Line, Stonington Line, Norwich Line, New Haven Line, Starin's Line, Joy Line, New Bedford Line, Central Vermont Line, Norwalk Line and the new Enterprise Transportation Company. The Maine Steamship Company, which operates a tri-weekly service between New York and Portland, handles a large share of the Maine passenger and freight traffic.—*Journal of Commerce, New York.*.

The Deadly Tender.

The railway mail clerks who have runs on the Rock Island are up in arms against that road as the result of a recent ruling that the company will not turn the mail cars, but will run them just as they happen to be picked up. The cars are divided into two sections. One contains the cases where the clerks are at work, and the other end is used for the purpose of storing the mail. Heretofore all the roads have turned the cars so as to have the storage end next to the engine. The advantage of this in case of a wreck can easily be seen. In every case of a head-on collision the tender telescopes the mail car, running back into the car from 10 to 15 ft. It has been estimated that the cost of turning the cars amounted to about 50 cents each time. The clerks are preparing a petition which will be sent to the department at Washington. If it is decided there that nothing can be done in the matter, a petition will be sent to Congress asking that a law be passed compelling the roads to turn the cars.—*Wichita (Kan.) Eagle.*

Train Lighting by Electricity in England.

The use of electricity for train lighting is now receiving increased consideration in England. The strong recommendations which were made by the Board of Trade inspectors who investigated the cause of the Witham accident on the Great Eastern at the end of last summer have been followed by the most noteworthy performance yet recorded in train electric lighting. The experiment has consisted of a long trial of the Leitner-Lucas system on the

Great Western express service between London and Plymouth, and between Plymouth and Penzance. Three of the patent equipments were run on this train during the months of October, November and December. The equipments remained under seal for this period, and when the seals were broken on January 1 a mileage of 23,800 miles for one coach and 25,200 miles for another had been run without any failure whatever in the lighting of the carriages. During the whole of the experimental period the dynamos with their oil wells, brush and reversing gear, automatic cut-outs, and also the storage batteries, were all under seal, so that nothing in the way of repairs, etc., could be done. The installation in one coach comprised 12 osmium lamps of 10 c.p. each in three first-class compartments, 10 12-c.p. carbon lamps in five third-class compartments, and eight 8-c.p. carbon lamps, making 304 c.p. altogether for the coach. It is reported that the energy consumption of the osmium lamps was from 1.7 to 2 watts per candle, and that of the carbon lamps 3½ watts per candle. The dynamo is of the Leitner-Lucas self-regulating type, of 2½ kw. capacity, and is used to charge a battery of accumulators giving 23 volts and having a capacity of 180 ampere-hours. The whole equipment for a train is self-contained and automatic. The dynamo has a single armature and commutator, but by means of a special arrangement employing a pair of auxiliary brushes, it is stated to give a practically constant current.

Exports in 1905.

The total value of exports of breadstuffs, provisions, cotton and mineral oils from this country during 1905 was $828,107,062, comparing with $729,341,151 in 1904 and $841,061,180 in the year before. The value of breadstuffs shows a great increase over 1904, but a large decrease from 1903, the figures being, respectively, $146,110,962, $92,311,812 and $192,920,616. Shipments of these staples have been increasing rapidly in the last four months, the figure for December, $26,475,200, being the largest for any month in the last four years at least. During 1905, 8,002,403 bales of cotton, valued at $392,224,458, have left the country, as compared with 6,556,953 bales, in 1904, the valuation then being $368,535,000. Wheat exports (included in breadstuffs) were 20,555,817 bushels, or $16,907,480 last year; in 1904 they were 13,015,394 bushels, $10,819,737. The number of barrels of wheat flour exported in 1905 was 11,281,937, valued at $49,694,482, the corresponding figures for 1904 being 11,368,503 barrels, $49,648,243. The value of provisions exported, including cattle, hogs and sheep, was $213,076,889 in 1905, and $190,277,172 in 1904. Mineral oils were exported in 1905 to the amount of 1,165,440,249 gallons, the value being $76,694,753. The price is noticeably lower than in 1904, when the value of the 985,729,957 gallons exported was $78,217,167.

Andrew Carnegie Research Scholarship.

The Iron & Steel Institute (London) is hereafter to award annualy, on the recommendation of the Council of the Institute, a research scholarship, or scholarships, Mr. Andrew Carnegie, past President of the Institute, having given $89,000 in 5 per cent. bonds for this purpose. Applicants, who may be of either sex or any nationality, must apply to the Secretary of the Institute before the end of February, on a prescribed blank form. The object of the scholarships is to enable students who have passed through college, or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects. Appointments are to be for one year, but may be renewed. Scholars are to report the results of their work, and where a scholar's paper is of sufficient merit, the Andrew Carnegie gold medal will be awarded. The Secretary of the Institute is Mr. B. H. Brough, 28 Victoria street, London.

A Handy Information Bureau.

The queerest illustration that we have seen of the value of journalism was the story of the passengers in a stalled train away off in New Mexico who telegraphed to *The Times*, asking the explanation of the delay which they could not secure where they were. Well within half an hour we were able to telegraph back to them that they had been "held up" for 58 hours at the little way station of Duran because there were snowdrifts in the Pecos Valley below them so deep and hard that the big rotary plows had not yet succeeded in cutting a path through. We also told them that their imprisonment would soon end, as arrangements were making to send their train westward over lines further to the south. Of course these passengers had sought nearer at hand for information before they looked for it 2,500 miles away. Incidentally, we cannot help wondering why a great railroad company should leave for almost three days the passengers on a transcontinental train in absolute ignorance as to the cause of their long detention, thus making it very much harder to bear, and certainly not accumulating popularity for the company's management. Corporations have an instinctive hatred for explaining their own mishaps and shortcomings, and as they all follow the same apparently stupid policy just as often and as long as they can there must be some good reason for it—from the corporation standpoint.—*New York Times.*

Sir George Gibb.

In our issue of January 5 we announced the appointment of Sir George Gibb as Deputy Chairman of the Underground Electric Company of London, which controls the Metropolitan, the Metropolitan District, the Great Northern, Piccadilly & Brompton, Baker Street & Waterloo, and Charing Cross, Eustin & Hampstead subways, and also the London United Tramways. Mr. Edgar Speyer was elected Chairman of the company to succeed Charles T. Yerkes, deceased. In the new organization, however, the management control rests with the Deputy Chairman, who has been a long and valued friend of the *Railroad Gazette.* The accompanying picture of Sir George Gibb is an excellent likeness. He was born at Aberdeen, Scotland, in 1850. His first railroad service was in 1877 as Assistant in the Solicitor's office of the Great Western. In 1882 he went to the North Eastern as Solicitor and became General Manager of that road in 1891. He acted as arbitrator for the North Eastern in the Wages Arbitration case in 1897, was appointed a member of the Committee on War Office Reorganization in 1901, a member of the Royal Commission on London Traffic in 1903, and visited the United States for the purpose of taking evidence in that connection. He was knighted in 1904.

In the 14 years that he has been General Manager of the North Eastern Railway his work has been in many ways radical if not almost revolutionary from a British standpoint. He has been the foremost advocate in Great Britain of ton-mile statistics and of heavy train loading—two topics which are sure to provoke much hostile discussion at any meeting of British railway shareholders, as was the case two years ago, when the ton-mile question was pretty thoroughly thrashed out by a number of large companies at their meetings. It is interesting and noteworthy in this connection to observe that some of the most conservative British companies, such as the London & North Western, really keep for their own use pretty full statistics, but do not publish them nor render them available to the inside or outside public. In the face of opposition, however, Sir George has been fearless and consistent in his methods. A solicitor by training, his entire attitude of mind is quite different from that of the traditional English manager. He has always wished to satisfy himself on important points *de novo*, and he analyzes the traditions of railway working as if they appertained to new matters instead of to old ones. For some years after he entered upon his duties as General Manager, he was chaffed more or less by his associates for inquiring most minutely into all the details of operation, asking questions which seemed to subordinate officers to be rudimentary. It is scarcely necessary for an American to be told that in this way he has acquired a wonderful knowledge of every detail of the working of a British railway. He knows where the profits are and where the losses are, and he has been most active in increasing the former and cutting down the latter. For example, in the last five years he has increased his freight train loads by 52 per cent. He has also introduced rail motor cars to handle branch line traffic, although at present not convinced of their economy; and his company, along with the Lancashire & Yorkshire, was a pioneer in electrifying branch line territory, with the important difference between the two that the Lancashire & Yorkshire designed its own power house equipment while the North Eastern buys its power, and apparently has the better bargain of it. The Scotch habit of mind looks into the future far more than does the English, and it is safe to say that there is no railway in Great Britain that has studied and discounted its future more intelligently in recent years than has the North Eastern. In his personality Sir George is quiet and modest and has much charm of manner.

Sir George Gibb.

A Comparison.

H. C. Barlow, executive director of the Chicago Commercial Association, says: "We hear much about the greatness of the railroads, but does not the average railroad place a high estimate on its own importance? The annual value of the manufactures within the limits of what is known as commercial Chicago is almost equal to the entire gross freight earnings of all the railroads of the United States. A Southern Railway agent was surprised a few days ago to find that the retail business done in Chicago by one merchant is larger than the entire business of Mr. Spencer's system."—*Chicago Press Despatch.*

The Gill-Alexander Operators' Call Bell.

This device is in use on about 40 railroads, including the Atchison, the Burlington, the Rock Island, the Chesapeake & Ohio, the Cincinnati, Hamilton & Dayton, the Colorado Midland, the Fremont, Elkhorn & M. V., the Great Northern, the Mexican Central, the Missouri, Kansas & Texas, the Missouri Pacific, the Northern Pacific, the Southern Pacific, and the Union Pacific. This device consists essentially of a call bell worked by a local circuit in a station telegraph office, which local circuit is closed by a combination of dashes sent over the wire by the train despatcher. The bell, when started, rings until the operator responds and opens the local circuit. The bell is made loud enough to wake him at night if it be placed by his bedside, or to draw his attention (when placed in the office) if he is engaged outside or in the freight house, or is at any place within hearing of the bell. The despatcher's office has different combinations of dashes for each office in which there is a call bell. There is an advantage over the ordinary Morse-sounder call, not only in loudness, but also in the fact that the call requires no repetition to be effective. Where a wire is busy it is not necessary to interrupt senders of messages to repeatedly call inattentive operators. This apparatus is in service at general offices, large warehouses, shops, in the homes of superintendents and train despatchers, and in many other situations. It is made by the Gill-Alexander Electric Co., Kansas City.

Another Brotherhood.

At Lancaster, Pa., January 11, the Brotherhood of Railroad Freight and Baggage Men of America held its second biennial convention, about 100 delegates being present. The President is R. P. Neil, of Lancaster.

Discouraging to the Gossips.

James J. Hill spent to-day in conference with officials of the Burlington. He denied absolutely the truth of all stories current that he desired connection with the Atlantic seaboard for his railroad. "Nineteen out of every twenty carloads coming over our lines from the Northwest change owners at Chicago. We are through with the consignments at the same time the owners are," said Mr. Hill.—*Chicago Press Dispatch.*

Proposed Monorail Road to Coney Island.

An application has been made to the New York Rapid Transit Commission for a route for a monorail line from the subway terminal in Brooklyn, N. Y., at Atlantic and Flatbush avenues, to Coney Island. F. B. Behr, President of the Behr Monorail Company, submitted the proposition to the board and asked for a public hearing.

Manufacturing and Business.

J. T. Keith, formerly Superintendent of the Lehigh Valley at Buffalo, is now Superintendent of G. B. Markle & Company, miners and shippers of coal, Jeddo, Pa.

The Allis-Chalmers Company, Milwaukee, Wis., has furnished a complete pumping equipment for the irrigation system of the Makee Sugar Company, Keila, Island of Kanan, Hawaiian Territory.

The General Storage Battery Co., New York, is to enlarge its factory at Boonton, N. J. The new buildings will contain 48,000 sq. ft. of floor space and will be devoted to the manufacture of the company's Bijur "High Duty" elements.

The Robins Conveying Belt Co., New York, has opened an office at 749 Railway Exchange Building, Chicago. Mr. C. Kemble Baldwin, Chief Engineer of the company, is in charge of this office, which will attend to all business for the Middle West.

The Lima Locomotive & Machine Company, Lima, Ohio, builders of the "Shay" geared locomotive, state that there are over 1,500 "Shay" locomotives in successful operation in all parts of the globe. The company's plant at Lima occupies over 14 acres of land.

The Chicago Pneumatic Tool Company, Chicago, is making arrangements for an addition to its compressor plant at Franklin, Pa. The present capacity of the plant is about 400 compressors per year. On the completion of the proposed extension the annual capacity of the plant will be between 650 and 700 compressors.

Five float bridges of the Pennsylvania Railroad for the freight ferries in the Harsimus Cove freight yard, Jersey City, are now raised and lowered by electric motors. The seven steel screws, 6 in. in diameter, on which a bridge is lowered and raised, were made by the Steele & Condit Company, of Jersey City, who also installed the electric motors furnished by the Westinghouse Company.

Several wood working machines have been shipped to the Harlan & Hollingsworth Co., Wilmington, Del., by the S. A. Woods Machine Co., Boston, Mass. Special attention is given to car shop machinery by the S. A. Woods Machine Co., and it has recently furnished equipment for a large number of railroad car shops, including a No. 10 car-sill dresser, a heavy vertical hollow chisel mortiser, and an automatic knife grinder for sharpening planer knives for the East Buffalo shops of the Lake Shore & Michigan Southern.

The J. G. Brill Company, car and truck builders, Philadelphia, Pa., are shipping 50 gondola cars to the Tramway Rural a Vapor, Buenos Ayres. This is a duplicate of an order of a year ago. The railroad company operates lines within the city of Buenos Ayres and has recently electrified its system. It also has a steam line running out of the city. The Brill Company is building at present 75 of its semi-convertible type of car for the city lines, and a fine dining car for the steam road. Practically all of the equipment of the Tramway Rural has been furnished by the J. G. Brill Company.

Iron and Steel.

A contract has been given by the Rio de Janeiro Light, Tramway & Power Company, to the United States Export Product Company, for 10,000 tons of rails.

Orders for rails have recently been given by the following companies: Pennsylvania Railroad, 20,000 tons in addition to the contracts given by this road last fall. The Missouri, Kansas & Texas has given an order for 20,000 tons of rails, and the Duluth, Virginia & Rainy Lake one for 8,000 tons; Syracuse Traction, 7,000 tons; Minneapolis, St. Paul & Sault Ste. Marie an additional order for 4,000 tons; Green Bay & Western, 3,000 tons; Texas & Pacific, 3,500 tons; International & Great Northern, 1,500 tons; Cleveland Frog & Switch Company, 1,000 tons. There also has been reported 500 tons for the Ramapo Valley Railroad and 1,000 tons for export to Costa Rica.

OBITUARY NOTICES.

Mr. Robert G. Erwin, formerly President of the Atlantic Coast Line, died of heart disease, at Saybrook, Conn., on January 13. Mr. Erwin resigned as President of the A. C. L. last November, remaining, however, a director of it, and of the Louisville & Nashville and other companies.

Mr. Homer F. Frost, Assistant General Freight Agent of the Chicago, Cincinnati & Louisville, died recently at Louisville, Ky., at the age of 61. Mr. Frost was appointed to the position he held at the time of his death in 1893. Before that he had been General Agent of the freight department at Louisville, Ky., and later Assistant General Freight Agent at Elkhart, Ind.

Mr. Francis J. Duke, Secretary and Treasurer of the Richmond, Fredericksburg & Potomac, died recently in Richmond, Va., of heart disease. Mr. Duke was born in 1842 and served as telegraph operator on the Louisa Railroad (now the Chesapeake & Ohio) during the war. In 1868 he went into the Treasurer's office of the Richmond, Fredericksburg & Potomac, being later appointed Assistant Treasurer, and finally Secretary and Treasurer.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Association of General Freight Agents.

This is the name of an association which was organized in New York City, November 21, and which proposes to hold its first general meeting soon. The organizers are all southern men, being officers of roads south of the Ohio and east of the Mississippi; but it is their purpose to have the coming meeting held in some centrally located city so as to attract freight officers of eastern, central and western roads. The object of the association is mainly to promote acquaintance and good-fellowship, but incidentally "to afford opportunity for the discussion of topics of general interest" to the freight department. The membership clause of the constitution makes eligible all freight traffic officers of the rank of Assistant General Freight Agent, or higher, actively connected with any regularly chartered steam railroad or coastwise steamship line of the United States, Canada, West Indies and Mexico. One-third of the membership is to constitute a quorum for the transaction of business. The President is D. M. Goodwyn, General Freight Agent of the Louisville & Nashville, Louisville, Ky. The other officers and

members of the Executive Committee are C. C. Cameron (I. C.), C. R. Capps (S. A. L.), R. L. McKellar (Southern), Key Compton (B. S. P. Co.), H. M. Emerson (A. C. L.), H. F. Smith (N., C. & St. L.), J. R. Ruffin (N. & W.), E. D. Hotchkiss (C. & O.), L. Green (Southern), and Haiden Miller (M. & O.).

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Buffalo & Susquehanna.—W. H. Baumes, Auditor, has been appointed Comptroller. T. J. Elmer succeeds Mr. Baumes.

Canadian Northern.—The general offices of this company have been moved from Toronto, Ont., to Montreal, Quebec.

Chesterfield & Lancaster.—A. H. Page, Vice-President and General Manager, has been elected President, and W. Godfrey, General Freight and Passenger Agent, has been elected Vice-President, both with offices at Cheraw, S. C.

East Broad Top.—S. J. Livingston has been elected Secretary and Treasurer, succeeding J. E. Haverstick, and C. D. Jones has been appointed Auditor, succeeding E. C. Hall, transferred, both with offices at Philadelphia, Pa.

Florida.—H. L. Edwards has been appointed Auditor, succeeding T. P. Alston, who remains Secretary, General Passenger Agent, Superintendent and Car Accountant.

Operating Officers.

Denver & Rio Grande.—H. T. Herr, Acting General Superintendent, has resigned. P. B. McAtee has been appointed Assistant Superintendent of the Fourth division, with authority from Chama, N. Mex., to Durango, Colo., including the Silverton and Farmington branches and the Rio Grande, Pagosa & Northern, with office at Durango. A. Meloney remains Assistant Superintendent of the Fourth division, with jurisdiction from La Veta, Colo., to Chama, N. Mex., including the Chama yards and the Creede and Santa Fe branches.

East Broad Top.—E. C. Hall, Auditor, has been appointed Assistant to the General Manager, with office at Orbisonia, Pa.

Flint River & Northeastern.—J. W. Byrd, Vice-President, General Manager and Purchasing Agent, has resigned. His duties have been assumed by J. F. Sikes, Superintendent.

Indiana Harbor.—Frank Beckwith, Engineer of Bridges and Structures of the Lake Shore & Michigan Southern, has been appointed General Superintendent of the Indiana Harbor, succeeding J. H. Snyder. F. T. Bowles, Superintendent of the Lake Erie & Western at LaFayette, Ind., has been appointed Superintendent of the Indiana Harbor, succeeding R. L. Scott.

Lake Erie & Western.—E. R. Bissell, Trainmaster at Lima, Ohio, has been appointed Superintendent at Muncie, Ind., succeeding W. J. Davis.

See Indiana Harbor.

Lake Shore & Michigan Southern.—See Indiana Harbor.

Mexican Central.—D. S. More, Acting Superintendent at Guadalajara, has resigned to become Traffic Manager of the Peruvian Central, with office at Lima, Peru. Mr. More was born in Milwaukee in 1864 and entered railroad service at the age of 16 as an operator on the Chicago, Milwaukee & St. Paul. Since that time he has served consecutively as station agent, despatcher, conductor, trainmaster and Acting Superintendent of several roads in the United States and Mexico.

Ohio River & Western.—The general offices have been moved from Zanesville, Ohio, to Woodsfield, Ohio.

Philadelphia, Baltimore & Washington.—James Buckelew, who has been appointed Superintendent of the Central division, was born in New Jersey in 1864. He graduated from Princeton in 1885, and entered the service of the Pennsylvania as rodman. The next year he was transferred to the maintenance of way department, and in 1888 was appointed assistant supervisor. He was made supervisor of the Tyrone division two years later, and next served in the same position on the Trenton Cut-off until he was appointed Assistant Engineer of the Middle division of the Philadelphia & Erie in 1900. The next year he returned to the Tyrone division as Assistant Engineer, and in 1902 was transferred to the Pittsburg division with the same title. In 1903 he was promoted to be Principal Assistant Engineer of the P., B. & W., where he has remained until his recent appointment.

St. Louis, Brownsville & Mexico.—W. J. Carnohan, Superintendent, has been appointed General Superintendent. George Huestis, Trainmaster, has been appointed Superintendent, succeeding Mr. Carnohan.

Tidewater.—E. E. Gardner has been appointed Car Accountant, with office at Norfolk, Va.

Traffic Officers.

Chicago, Rock Island & Pacific.—See St. Louis & San Francisco.

Delaware, Lackawanna & Western.—W. E. Dowle, Division Freight Agent at Buffalo, has been appointed to the new office of Assistant General Freight Agent; headquarters unchanged.

Minneapolis, St. Paul & Sault Ste. Marie.—H. M. Lewis, Chief Clerk to the General Passenger Agent, has been appointed Assistant General Passenger Agent, with office at St. Paul, Minn., succeeding W. S. Thorne, deceased.

National Lines of Mexico.—W. B. Ryan, Traffic Manager, has resigned, and the office has been abolished.

St. Louis & San Francisco.—The authority of W. B. Biddle, Third Vice-President in charge of traffic of the Chicago, Rock Island & Pacific, has been extended over the St. Louis & San Francisco.

Western Maryland.—B. H. Griswold, General Traffic Manager, has resigned, and the office has been abolished. J. T. Hendricks, Assistant General Freight Agent, has been appointed Freight Traffic Manager, and the office of Assistant General Freight Agent has been abolished.

Wheeling & Lake Erie.—W. C. Maxwell, who was recently appointed Assistant General Traffic Manager of this road and of the Wabash Pittsburg Terminal, was born in 1865 and entered railroad service as a messenger boy on the Chicago, Burlington & Quincy. He remained with that road for 24 years, being in the local freight service, then in the general freight office, and later serving as general agent, being finally promoted to the office of Assistant General Freight Agent. On Sept. 1, 1905, he came to the Wabash as Assistant General Traffic Manager, his jurisdiction being extended over the W. & L. E. and W. P. T. on Jan. 1, 1906.

Engineering and Rolling Stock Officers.

Atlantic Coast Line.—C. M. James, who has been appointed Engineer of Roadway of the lines north of Savannah of the Atlantic Coast Line, was born in 1875. He graduated from the Baltimore Polytechnic Institute and entered railroad service as rodman on the Baltimore & Ohio. He was promoted through various stages until he became Assistant Engineer in 1899. In 1904, he went to the Atlantic Coast Line as Assistant Engineer. He was appointed Acting Engineer of Roadway in July, 1905, and the appointment was made permanent on the first of this month.

Brandon, Saskatchewan & Hudson's Bay.—P. E. Thian, who was recently appointed Chief Engineer of this road, was born in 1862 and graduated at Georgetown University in 1881. He started railroad work the same year in the engineering department of the Denver & Rio Grande. In 1882, he went to the Canadian Pacific, and four years later to the Chicago, Milwaukee & St. Paul, being later appointed First Assistant Resident Engineer at Kansas City. Later he went to the New Orleans & Northwestern as Assistant Engineer on Construction, and, in 1890, became Locating Engineer in Washington for the Northern Pacific. In 1894 and 1895, he was City Engineer at Everett, Wash., and for the next few years was engaged in mining work and in the United States Geological service. He returned to railroad work in 1899 as Assistant Chief Engineer of the Kootenay Valley. He then became Engineer of Construction on the Montana Central, and in 1901 went to the Algoma Central as Locating Engineer. After being engaged for a time in Mexico in mining, he became Assistant Chief Engineer of the Oregon Water Power & Railway Co. In 1904, he went to the Great Northern as Locating Engineer, from which position he has resigned to accept his present appointment.

P. E. Thian.

Great Northern.—J. C. Paterson, Principal Assistant Engineer, has been appointed to the new office of Assistant Chief Engineer at St. Paul, Minn. Alexander Stewart, Resident Engineer at

Seattle, Wash., has been appointed to the new office of Assistant Chief Engineer at that place.

Six districts for Resident Engineers have been established, as follows: St. Paul district, office at St. Paul, Minnesota, with jurisdiction over the Terminals division, Willmar division, Willmar & Sioux Falls Railway, Breckenridge division and Fergus Falls division. Superior district, office at Superior, Wisconsin, with jurisdiction over the Superior division and Mesabi division. Grand Forks district, office at Grand Forks, North Dakota, with jurisdiction over the Northern division and Dakota division. Minot district, office at Minot, N. Dak., with jurisdiction over the Minot division, Montana division and Montana Central Railway. Spokane district, office at Spokane, Wash., with jurisdiction over the Kalispell, Spokane division, and Spokane Falls & Northern System. Seattle district, office at Seattle, Wash., with jurisdiction over the Cascade division and coast lines.

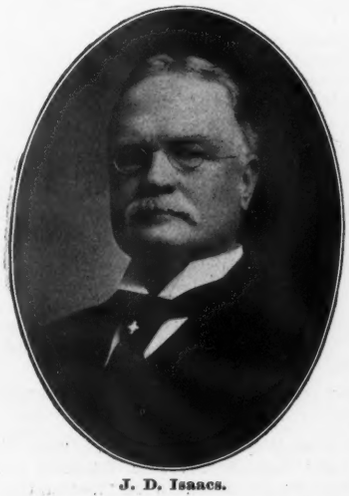
P. S. Hervin has been appointed Resident Engineer of the Grand Forks district. C. H. Swigart has been appointed Resident Engineer of the Seattle district.

Huntingdon & Broad Top Mountain.—A. E. Yohn has been appointed Master Mechanic, with office at Saxton, Pa., succeeding C. R. Yohn, resigned.

Pennsylvania.—W. H. Brown, Chief Engineer, is to be retired on pension on March 1st. H. S. Meily, Supervisor at Middletown, Pa., has been appointed Assistant Engineer at Buffalo, N. Y., succeeding E. Lee, transferred.

A. W. Byron has been appointed Assistant Master Mechanic at Olean, N. Y.

Southern Pacific.—John Dove Isaacs, who was recently appointed Consulting Engineer of the Southern Pacific, Union Pacific, Oregon Short Line, and the Oregon Railroad & Navigation, was born in Virginia in 1848. He graduated from the University of Virginia in 1869, and entered railroad service in 1875 on the Southern Pacific as a draftsman. He became chief draftsman the next year, and in 1885 was appointed Assistant Superintendent of Bridges and Buildings. Five years later he was made Acting Superintendent of Bridges and Buildings, and, in 1891, was appointed Second Assistant Engineer of Maintenance of Way. He was promoted, in 1900, to be Assistant Engineer of Maintenance of Way of the Pacific System of the Southern Pacific, and of the S. P. Lines in Oregon, which position he has held ever since, being, however, appointed, in 1901, also Engineer of Bridges of both the Pacific and Atlantic Systems of the Southern Pacific.



J. D. Isaacs.

Special Officers.

Minnesota Railroad & Warehouse Commission.—Dwight C. Morgan, formerly with the Chicago, St. Paul, Minneapolis & Omaha, has been appointed by the Commission to take charge of the valuation of railroad properties in Minnesota. Mr. Morgan was born in Illinois in 1868 and is a graduate of the University of Michigan. In 1887 he was engaged in the government service in reporting upon the value and cost of reproducing the Central and Union Pacific Railroads. He was later Assistant Engineer on construction of the Illinois Central bridge across the Ohio river at Cairo, Ill., and after that had the same position on the construction of the Merchants' bridge at St. Louis. In 1891, he was instrument man on construction on the Northern Pacific, and then was appointed Assistant Engineer of Maintenance on the Southern Pacific. He resigned from this position to join his father in the firm of Richard P. Morgan & Son, Civil Engineers. In 1893 he was appointed the Consulting Engineer of the Illinois Railroad & Warehouse Commission. He returned to railroad work in 1899, as Assistant Engineer of the Chicago & Alton, and later was appointed Engineer of Maintenance of that road. In 1901 he was appointed Assistant Engineer of the Chicago Great Western, and the next year went to the Chicago, St. Paul, Minneapolis & Omaha, where he was for two years Assistant Engineer and later Assistant to the General Superintendent.

D. C. Morgan.

LOCOMOTIVE BUILDING.

The Italian Railway Administration is asking prices on 50 locomotives.

The Chesapeake & Ohio, it is reported, is in the market for switching locomotives.

The Southern of Peru has ordered 10 locomotives from the Rogers Locomotive Co.

The Western, of Havana, has ordered two locomotives from the Rogers Locomotive Works.

The Chicago, Indianapolis & Louisville has ordered four locomotives from the American Locomotive Co.

The Denver & Rio Grande has ordered 20 consolidation locomotives from the American Locomotive Company.

The Illinois Central, it is reported, has ordered 75 locomotives as follows: Twenty-five passenger, 25 freight and 25 switching locomotives.

The Sierra Railway Company, of California, has ordered four oil burning locomotives from the H. K. Porter Company, instead of two as reported in our issue of December 29.

The Grand Trunk has ordered 20 passenger locomotives and 61 freight locomotives. It is reported that all of the locomotives with the exception of ten of the passenger locomotives will be made in Canada.

The Mexican Central is considering the purchase of 25 simple locomotives as follows: Twenty consolidated freight locomotives and five six-wheel switchers. Nothing has been determined as yet in regard to the details of the locomotives.

CAR BUILDING.

The Illinois, Iowa & Minnesota is in the market for 500 box cars.

The Kansas City Southern is figuring on buying 100 freight cars.

The Pullman Co. is asking bids on material for 200 refrigerator cars.

The Detroit, Toledo & Ironton is reported as in the market for some coal cars.

The Lehigh & Hudson River is reported as in the market for 300 freight cars.

The Denver & Rio Grande, it is reported, is figuring on buying 1,000 dump cars.

The Milwaukee Electric Railway & Light Company is figuring on buying 50 cars.

The Long Island is reported as in the market for additional freight equipment.

The California North-Western expects to be in the market soon for 100 freight cars.

The Mexican International is in the market for 300 gondola cars of 80,000 lbs. capacity.

The Mexican Central is in the market for 950 box cars, 160 stock cars and 75 flat cars.

The Seaboard Air Line has ordered 1,000 box cars from the American Car & Foundry Co.

The Tidewater has ordered 100 flat cars and 300 stock cars from the Western Steel & Foundry Co.

The Atchison, Topeka & Santa Fe, it is reported, will shortly be in the market for additional tank cars.

The Spokane International has ordered six passenger and three baggage cars from the Wason Manufacturing Co.

The Chicago, Rock Island & Pacific is in the market for five observation cars, five postal cars and three dining cars.

The Bolivia National is figuring on the purchase of 100 passenger cars, 50 baggage and express cars and two private cars.

The Toledo, St. Louis & Western is about to order 1,000 box cars of 60,000 lbs. capacity, and 750 gondolas of 80,000 lbs. capacity.

The Oregon Railroad & Navigation Company has ordered 45 tank cars of 12,500 gallons capacity from the Pressed Steel Car Company.

The Pennsylvania, it is reported, will shortly order a number of passenger cars for use on its West Jersey & Seashore line, which is now being electrified.

The Midland Valley is in the market for 600 coal cars of 80,000 lbs. capacity and 250 36-ft. standard box cars. Address Henry Wood, Vice-President, Girard Building, Philadelphia, Pa.

The Lake Shore Electric has ordered ten 51-ft. cars from the Niles Car & Manufacturing Co. The cars will weigh approximately 34 tons. The special equipment includes: Westinghouse air-brakes and Baldwin trucks.

The Southern Pacific has ordered 300 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars are similar in every respect to those ordered by the Union Pacific, the details of which are given above.

The Union Pacific has ordered 300 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will measure 39 ft. 10¾ in. long x 8 ft. 2¾ in. wide x 7 ft. 6$^{9}/_{16}$ in. high, all inside dimensions. The bodies will be of wood, and the underframes will be of metal. The special equipment will include steel bolsters, Congdon brake-shoes, Hewitt brasses, Climax couplers, Miner draft rigging, and Railway Steel Spring Company's springs.

The Buffalo, Rochester & Pittsburg, as reported in our issue of December 22 last, has ordered 200 steel hopper coal cars of 100,000 lbs. capacity from the Standard Steel Car Co., for June delivery. The special equipment includes: Atha cast-steel bolsters, Pennsylvania steel brake-beams, Westinghouse air-brakes, Climax steel couplers, Sessions draft rigging, Symington journal boxes, Patterson Sargent paint, and Railway Steel Spring Company's springs.

The Chicago & Milwaukee Electric, as reported in our issue of December 22 last, has ordered 10 closed interurban motor cars from the Jewett Car Co., for May delivery. These cars will weigh 34 tons, and measure 53 ft. 4 in. long, 9 ft. 6.5 in. wide and 14 ft. 2 in. high, over all. The special equipment includes: Chicago & Milwaukee standard brake-shoes, Van Dorn couplers and draft rigging, Hartshorn curtain fixtures, Pantasote curtain material, P. Smith heating system and Railway Steel Spring Company's springs.

The Fort Smith & Western has ordered 100 box cars of 60,000 lbs. capacity from the Mt. Vernon Car Works. These cars will measure 36 ft. ½ in. long x 8 ft. 6 in. wide x 8 ft. 3 in. high, all inside dimensions. The bodies will be of wood and the underframes will be of steel. The special equipment includes Bettendorf bolsters, Mt. Vernon brake-beams, Westinghouse brakes, Moore-Jones brasses, Climax couplers, Minor tandem draft rigging, Harrison dust guards, McCord journal boxes, Winslow improved roofs, and Mt. Vernon car wheels.

The Wabash has ordered 1,000 wooden box cars of 80,000 lbs. capacity and 1,000 wooden coal cars from the American Car & Foundry Co.; 2,000 composite gondola cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co., and 2,000 composite gondola cars of 100,000 lbs. capacity from the Standard Steel Car Co. The box cars are for June and July delivery and will be 40 ft. long x 8 ft. 6 in. wide x 9 ft. 3 in. high, all outside measurements. All gondola cars are for September and October delivery, and will be 41 ft. long x 9 ft. 5 in. wide. The special equipment for the box and gondola cars will include Westinghouse air-brakes, Climax couplers, Railway Steel Spring Co.'s springs and arch-bar trucks.

BRIDGE BUILDING.

Atlantic City, N. J.—Application has been made by the Cape May Board of Free Holders, to the Atlantic County Board, to jointly build a bridge to connect Beasley's Point with Somers Point, for which plans are being made.

Bethlehem, Pa.—The Bethlehem Street Bridge Company has been chartered at Harrisburg, Pa., to build a bridge to connect Bethlehem with South Bethlehem.

Birmingham, Ala.—The County Board of Revenue is taking action towards building a bridge over the Warrior, to cost about $20,000.

Carthage, Tenn.—A private stock company is being organized to build a steel bridge over the Cumberland river, to cost $50,000. Bids are to be asked next month.

Fort Francis, Ont.—Application has been made for incorporation by a company in which Z. A. Lash, of Ontario, is interested, to build a combined railroad and highway bridge over the Rainy river near this place. This is supposed to be a Mackenzie & Mann project.

Laporte, Ind.—Bids are wanted February 6 by the Board of County Commissioners, for building six iron bridges in Laporte County.

Lewisburg, Pa.—A contract has been given to the Oswego Bridge Company, of New Jersey, at $124,580, for building the new bridge over the river at this place. The proposed structure will have five piers in the river. It will be 1,230 ft. long, 22 ft. wide, and is to be completed within one year of the date of signing the contract. There were 12 bidders. The Oswego Bridge Co. submitted bids for 35 different designs.

Nashville, Tenn.—The Grand Court of Davison County, at a recent meeting, decided to build a bridge over the Cumberland river, in North Nashville, to cost about $300,000.

Newark, N. J.—The Public Service Corporation has been asked by the boards of Essex and Hudson Counties to decide whether it will pay one-third of the cost of building a bridge over the Passaic river at Clay street. The total cost of the structure will be $150,000.

Pembroke, Ont.—Bids are wanted Jan. 22 by James Coxford, Chairman of the Committee, for building a steel bridge on stone abutments over the Madawaska river, in the County of Renfrew. James H. Smith is County Engineer.

Peoria, Ill.—The Chicago & Alton and Vandalia lines, it is said, have decided to withdraw from their terminal arrangements with the Peoria and Pekin Union, and are planning to build a bridge over the Illinois river at this place.

Philadelphia, Pa.—Preliminary work has been started on the concrete bridge over the Wissahickon creek and ravine at Walnut Lane. The plans call for a structure with a central arch of 225 ft., 60 ft. wide and 120 ft. high, with approaches of 45 ft. at each end. The cost of the structure will be about $200,000.

Portland, Ore.—The Northern Pacific has given an order for 20,000 tons of steel for its bridges to be built over the Columbia and Willamette rivers. It is planning to have both bridges completed by 1907.

Spokane, Wash.—Plans of the Northern Pacific for a new bridge over the subway at Washington street have been submitted to the Board of Public Works.

Richmond, Va.—The Richmond and Chesapeake Bay has been granted permission by the Board of Supervisors, of Henrico County, to build a viaduct over Oak, Bacon, Shedd and Henrico streets.

St. Boniface, Man.—A new bridge is proposed over the Seine river at this place.

Trenton, N. J.—In the House of Representatives on January 11 a bill was introduced authorizing the Pennsylvania Railroad Co. and the Pennsylvania & Newark Railroad Co. to build, maintain and operate a bridge across the Delaware river.

Yankton, S. Dak.—On January 10th the U. S. Senate passed the bill extending the time for commencing and completing the bridge of the Winnipeg, Yankton & Gulf over the Missouri river at this place.

Other Structures.

Baltimore, Md.—The Pennsylvania has given a contract for building a grain drier, to have a capacity of 15,000 bushels per day. It is expected to have it ready for service by April 1.

Green Island, Troy, N. Y.—The Federal Railway Signal Company will build an addition to its works on Center street, largely increasing the capacity of the shops.

Lowell, Mass.—The New York, New Haven & Hartford, it is said, is having plans made to build an outbound freight house 300 ft. x 40 ft., and an inbound freight house 200 ft. x 25 ft.

Pittsburg, Pa.—The Pennsylvania Company is considering the question of putting up additional shops at Columbus, Ohio, and at Fort Wayne, Ind., or Crestline, Ohio.

San Francisco, Cal.—The Southern Pacific, it is said, has begun work on large sheds on a plot of ground at North Oakland abutting San Francisco bay, which the Western Pacific has been trying to secure as a site for its proposed terminal. This action is the result of strife for advantage in terminal locations and will lead to further strife.

Washington, Pa.—The Pennsylvania Company, it is reported, has given a contract to a local firm to put up a brick passenger station to cost about $40,000.

WINDSOR, ONT.—The Canadian Pacific, it is said, is planning to make alterations to its station at this place.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—See San Francisco & Northwestern, below.

BUTTE COUNTY.—This company, which recently completed an extension of its road from Stirling City, Cal., to Gallagher, a distance of 17 miles, is building an additional 15 miles from the latter place to North Valley.

CANADIAN PACIFIC.—Announcement has been made that this company will build a loop 20 miles long in Field, B. C., to overcome several heavy grades. The estimated cost of the work, which will be heavy, through rock, is about $1,200,000.

CANADIAN ROADS.—Application will be made at the next session of the Dominion Parliament by Robertson & Robertson, of British Columbia, for permission to incorporate a company to build a railroad from the city of Vancouver or a point on Burrard Inlet to the northern boundary of the province by way of Lillooet, the Fraser valley, Tacla lake, Stinkine and Teslin lake, or by the most feasible route through the Chilcotin valley.

CHARLESTON, PARKERSBURG & WESTERN.—Incorporation has been granted a company under this name in West Virginia to build and operate a railroad for a distance of eight miles from Charleston, W. Va., to develop the Bruen coal fields north of that place. A. S. Alexander is President and C. P. Peyton, Vice-President and General Manager. The board of directors include F. M. Staunton and Alexander J. Bruen, of New York.

CHICAGO & ILLINOIS WESTERN.—This company, which recently completed 15 miles of road between Hawthorne and Willow Springs, is making surveys to extend its road southwest through Joliet and thence west across Illinois to the Mississippi river, aggregating about 225 miles.

CINCINNATI, GEORGETOWN & PORTSMOUTH.—This company, which recently extended its line to Russellville, Ohio, has given a contract to Thomas Daulton for building four miles additional from that place east to Eagle Creek, and has completed surveys for an additional 12 miles east from the latter place.

GRAND TRUNK PACIFIC.—It is reported that this company has completed its survey into Edmonton, and that it has under consideration two routes. This survey covers the entire distance from Portage la Prairie to Edmonton, with the exception of a 20-mile stretch about 100 miles east of Edmonton.

This company has been granted additional privileges in Port Arthur and Fort William, including permission to run a track alongside the Canadian Pacific track from Port Arthur to Fort William.

GREAT MINERAL OF MEXICO.—This company, which was recently organized with a capital stock of $3,000,000, is planning to build an extensive system of railroads in the western part of Mexico. The company has acquired the Pittsburg-San Jose Railroad, which at present is built out of San Jose del Sitio for a distance of about 25 miles. This road will be extended southward to a connection with the Kansas City, Mexico & Orient and northward to the city of Parral. M. B. Place, of Pittsburg, Pa., promoted the organization of the company. The route of the proposed new lines is through a rich mining section. E. S. Stafford has been named as chief engineer of the road.

GREAT NORTHERN.—See Vancouver, Victoria & Eastern below.

GULF & NORTHWESTERN.—This company, which is building a line from Waco, Tex., northwest via Meridian and Stevenville to Thurber, a distance of 110 miles, is making surveys from Waco to Strawn and securing rights of way. No contracts have as yet been let, but as soon as this survey is completed, contracts for the first 40 miles from Waco to Meridian are to be let. (August 18, p. 54.)

KAMLOOPS & YELLOWHEAD PASS.—Application will be made to the British Columbia Parliament by Tupper & Griffin, of Vancouver, for authority to incorporate a company under this name to build a railroad from a point at or near Kamloops north, following the valley of the North Thompson river, Canoo river and McLennans creek, to a point at or near Tete Jaune Cache, in the province of British Columbia.

MEXICAN CENTRAL.—The Paredon extension of this road, it is said, will be completed and opened for traffic about next June. The Federal Government may modify its exclusive concession granted to the National of Mexico, in which the latter is given the exclusive right to occupy a strip of country 20 miles wide bordering the Rio Grande for a length of 400 miles, so as to enable the Mexican Central to build to the Rio Grande border. If this modification is decided upon, the Paredon line will probably be extended to San Antonio, Tex., crossing the Rio Grande at a point about 25 miles above Laredo.

This company's engineers have located the route for its proposed Mexico City-Tampico line. The maximum grade will be 2½ per cent., with 6 per cent. curves. The time for beginning construction work has not yet been decided upon, but it may be started during the present year.

MEXICAN ROADS.—An important line of railroad is to be built in the state of Yucatan by Juan N. Martinez and associates. The proposed line will run from San Ignacio to Huchucma. Mr. Martinez obtained a concession from the federal government some time ago for building this road, and now has everything in shape to begin work.

MIDWAY & VERNON.—Application will be made by this company to the Dominion Parliament at its next session for authority to build a railroad from Vernon, B. C., to Kamloops and also to build a branch line from some point on the company's line to Penticton.

MINNEAPOLIS, RED LAKE & MANITOBA.—This company, which recently completed a 26-mile extension of its road in Michigan, has given a contract to Halverson & Carkon for rebuilding its old line from Nebish north to Red Lake, a distance of about 12 miles.

MISSISSIPPI CENTRAL.—An officer writes that this company, which recently extended its road from Silver Creek, Miss., west to the Pearl river, has given a contract to the Worthington Construction Co., of Birmingham, Ala., for an extension from the Pearl river west to Brookhaven, an additional 22 miles. The company is also projecting a line from Brookhaven across the state to Natchez, an additional 70 miles.

MUNISING.—An officer writes, respecting the proposed action to be taken by this company asking for authority to extend its lines, that the company has been allowed to amend its charter to extend its main line west from Little Lake, in Marquette County, Mich., to Princeton mine, a distance of about eight miles. Work is now under way, and the line will probably be ready for operation in June of this year. December 8, p. 183.)

NATIONAL OF MEXICO.—This company, it is reported, is projecting a road from Teziutlan to Fubers to develop the oil fields owned by the Oil Fields Company of Mexico. Surveys for the proposed road have been made under the direction of J. M. Reed, Chief Engineer o fthe National, and it is said that the road will soon be built.

NEW YORK CANADIAN PACIFIC.—This company, which during the past summer has been making extensive surveys for its proposed railroad from New York City to Canada, has filed an application in New York for an extension of its corporate existence. The authorized capital is $10,150,000. The length of the proposed road is 332 miles. Verplanck Colvin is President, and George C. Van Tuyl, Treasurer, both of Albany.

NEW YORK CENTRAL & HUDSON RIVER.—This company, it is reported, has bought a large plot of ground in West Albany, N. Y., on which to lay from 10 to 15 additional yard tracks.

OREGON WATER POWER & RAILWAY COMPANY.—This company, operating 52 miles of railroad in Oregon, is making surveys to build an extension of its road from Cedarville to Troutdale, a distance of 7½ miles.

PACIFIC COAST RAILWAY (PACIFIC COAST CO.).—This company will build an extension from a point on its line at Santa Maria, Cal., to Shuman, a distance of three miles; also one from Santa Maria to Shuey, seven miles.

PORTLAND & SOUTHWESTERN.—Incorporation has been granted a company under this name in Oregon with a capital of $100,000 to build a railroad from Scappoose to Nehalem Bay. The incorporators include H. G. Platt, of Portland, and G. J. Perkins, of Portland.

RIO GRANDE, SIERRA MADRE & PACIFIC.—The survey for the proposed extension of this road from Nueva Casas Grandes to Temosachic has been completed. From Temosachic the road will be continued into timber lands owned by W. C. Green, of New York, and will eventually be extended to the port of Topolobampo, on the Pacific coast.

SALT LAKE & OGDEN.—This company, which recently completed six miles of new line in Utah, is building from Layton north to Ogden, an additional 15 miles.

SAN FRANCISCO & NORTHWESTERN (A., T. & S. F.).—An officer writes that this company, which recently added 1.3 miles of new line, bringing its southern terminus to Shively, Cal., has projected a line from that point south to San Francisco, a distance of 260 miles.

SOUTHERN.—This company, according to reports, has given a contract to W. J. Oliver & Co., of Knoxville, Tenn., at about $5,000,000 for building its Johnson City road, which will be a coal line from Embreeville, Tenn., to Marion, N. C.

SOUTH SIDE COAL & IRON.—An officer writes that this company,

which proposes to build a railroad from Paris, Ark., east to Dardanelle, a distance of 38 miles, will begin construction work about the 15th of next month. He denies the report that this road is owned by the Kansas City Southern. (August 18, p. 55.)

Temiskaming & Northern Ontario.—This company, which is building 100 miles north of its present terminus at New Liskeard, Nipissing, Ont., has 80 miles graded and 40 miles of track have been laid. The grading on the remaining 20 miles will be finished this spring, and it is expected to have the entire line in operation next fall.

Texas Roads.—John H. Kirby, of Houston; Henry King, and others, have applied for a charter for a new road to run from Burr's Ferry, in Jasper County, to Rockland and Chester, in Tyler County, a distance of 80 miles. The proposed road will cross the Santa Fe, the Southern Pacific and the Missouri, Kansas & Texas, and is to form a connecting link in the lines of the Yoakum System. The contract for the work, it is said, will be given as soon as surveys are completed.

Toluca, Marquette & Northern.—This road has extended its line from its northern terminus at McNabb, Ill., north for a distance of five miles to Granville.

Uniontown & Wheeling Short Line.—Construction work has been commenced by this company on its proposed railroad from Uniontown, in Fayette County, Pa., west to Wheeling, W. Va., 68 miles. The company is building with its own force the abutments for the large bridge to cross the Monongahela River at McCann's Ferry, and has let contracts to the American Bridge Co. and the Jones & Laughlin Steel Co. for the superstructure. The total cost of the bridge will be about $1,000,000. Contracts will shortly be let for grading and also for building seven tunnels on the line of the proposed road. (November 3, p. 144.)

Vancouver & Northwestern.—This company will apply to the legislative assembly of the province of British Columbia for permission to incorporate a company and build a railroad from Vancouver eastward to the Pitt river, thence continuing east to Lillooet river and to the Stave river, thence to the Harrison river and north to a point at or near Lillooet, via Fort George, on the Fraser river by the most feasible route to the sixtieth degree of latitude.

Vancouver, Victoria & Eastern. (Great Northern).—Surveys, it is said, have been completed by this company for its proposed line from Midway to Hope, B. C. Construction work is to be commenced at once from Hope to Chilliwack.

Western Allegheny.—Contracts, it is reported, will shortly be let by this company for building its proposed extension from Newcastle, Pa., to East Brady.

Willamette Valley Traction.—Grading work has been commenced on this proposed electric road at Salem, Ore. It is proposed to build north to Portland, 50 miles. The promoters of the road say that it is being financed by New York capitalists. The project is known under the above name, although it does not appear that the company has as yet been incorporated.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—See Denver, Enid & Gulf.

Atlantic Coast Line.—This company has finally acquired the Macon, Dublin & Savannah, which it bought in October, 1904, but the taking over of which has been delayed by litigation. The M., D. & S. runs from Macon, Ga., to Vidalia, 94 miles, and has $1,500,000 first mortgage 5 per cent. bonds of 1951, and $1,250,000 capital stock outstanding.

Chesapeake & Ohio.—It is announced from London that an agreement has been made between the Chesapeake & Ohio, the Norfolk & Western, and the Southern for shipping freight from Newport News and Norfolk to Liverpool and London by the Furness Line. The Furness Line is to take over the boats of the Chesapeake & Ohio Steamship Company and also those of the Neptune Steamship Company. The Chesapeake & Ohio Steamship Company is a British corporation, but is controlled by the C. & O. through ownership of three-fifths of its capital stock.

Chicago, Milwaukee & St. Paul of Washington.—The Pacific Railway Co. has filed amended articles of incorporation changing its name to the Chicago, Milwaukee & St. Paul of Washington.

Cincinnati, Hamilton & Dayton.—See Pere Marquette.

Denver, Enid & Gulf.—The entire outstanding capital stock of this company, amounting to $1,120,000, has been purchased by the Atchison, Topeka & Santa Fe. The D., E. & G. has 119 miles of road between Guthrie, Okla., and Kiowa, Kan., and has $1,120,000 5 per cent. mortgage bonds outstanding.

Detroit, Toledo & Ironton.—The gross earnings for the six months ended December 31, including those of the Ann Arbor, were $2,069,140, and net earnings $662,057.

Great Northern.—The New York Stock Exchange has been asked to list $25,000,000 additional preferred stock of this company. This is the stock which it was announced last October would be issued to the stockholders at par. (Oct. 13, p. 120.)

Illinois Central.—Gross earnings of this company for the month of November were $4,588,622, an increase of $148,962, and net earnings were $1,613,743, an increase of $18,105. This is the first month of the current fiscal year in which the earnings of this company have shown an increase, the yellow fever quarantine having affected them badly until some time in October.

Long Island Consolidated Electric.—This company has been organized as a holding company for the purpose of taking over the control of the various subsidiary electric lines owned or controlled by the Long Island Railroad, as well as such other electric lines as may be either bought or built. A meeting of the new company has been called for March 14 to approve an issue of $10,000,000 4½ per cent. 40-year collateral trust mortgage bonds. The electric lines to be held by the new company are the Huntington Railroad, Ocean Electric, Northport Traction, Nassau County Railway, Glen Cove Railroad, and the Jamaica & South Shore. The cost of the purchase or construction of these lines, up to Nov. 1, 1905, is given as $779,235, and their total length is 65 miles. It is announced that the new company will also hold one-half of the capital stock and bonds of the New York & Long Island Traction, and of the Electric Railway Co.; this proportion of the securities of the N. Y. & L. I. is already owned by the Long Island Railroad, and the securities of the other company are to be immediately acquired. The total cost of its future interest in both of these companies is given as $1,360,508.

Macon, Dublin & Savannah.—See Atlantic Coast Line.

Missouri Pacific.—This company has sold to a syndicate composed of Kidder, Peabody & Co., F. S. Mosely & Co., of Boston, and Baring, Magoun & Co., of New York, an issue of $6,000,000 5 per cent. collateral notes of 1908. They will be used to refund an issue of similar notes for the same amount maturing Feb. 10, 1906, and are secured by deposits of the following collateral with the Equitable Trust Co. of New York: twenty thousand shares of Wabash preferred, 100,000 shares Denver & Rio Grande common, 40,000 shares Denver & Rio Grande preferred, and 25,000 shares St. Louis, Iron Mountain & Southern. The underwriting syndicate has already sold the entire issue.

Northern Securities.—The balance sheet of this company, as of Dec. 31, 1905, has been issued and is the first official statement of the assets of the company made public since Dec. 31, 1902. The statement shows that since the date of organization, Nov. 13, 1901, dividends of $39,886,688 have been collected on stocks belonging to the company, and dividends of $36,299,620 have been paid on the stock of the company. The present capital stock has a par value of $3,954,000, but its market value is between two and three times this sum. Stocks of other companies held as assets were acquired at a cost of $6,047,666, but it is not stated what these stocks are. The cash on hand amounts to $420,768, from which is to be substracted the 5 per cent. dividend recently declared. (Dec. 15, p. 194.)

Pacific.—See Chicago, Milwaukee & St. Paul of Washington.

Pennsylvania.—The estimated gross earnings of this company for the year ended Dec. 31 were $135,000,000, an increase of nearly $17,000,000 over 1904. The net earnings, also estimated, were $42,000,000, an increase of about $5,750,000. This makes nearly 11 per cent. earned on capital stock before deducting betterments. The gross earnings for November were $12,580,725, the largest figure on record.

Pere Marquette.—An order has been issued by the United States Circuit Court in Ohio directing the receiver of the C., H. & D. to surrender the stock and leasehold of the Pere Marquette held by the C., H. & D. This order was issued on the petition of W. B. Horn, the original complainant in receivership proceedings, on the ground that if the receiver adopted the lease it would impose upon the C., H. & D. an annual charge of over $750,000, and that the lease is unprofitable and burdensome.

Pittsburg, Youngstown & Ashtabula.—Under this name, the New Castle & Beaver Valley, which operates 15 miles of road, and the Pittsburg, Youngstown & Ashtabula, which operates 125 miles of road, are to be consolidated, the shareholders of the two roads having ratified the agreement recently. Both roads are controlled by the Pennsylvania Company, but are operated under their own organization.